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# USSR Report

NATIONAL ECONOMY

EKO: ECONOMICS AND ORGANIZATION OF  
INDUSTRIAL PRODUCTION

No 1, JANUARY 1987

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1 APRIL 1987

USSR REPORT

NATIONAL ECONOMY

EKO: ECONOMICS AND ORGANIZATION OF  
INDUSTRIAL PRODUCTION

No 1, January 1987

Except where indicated otherwise in the table of contents the following is a complete translation of the Russian-language monthly journal EKONOMIKA I ORGANIZATSIIA PROMYSHLENNOGO PROIZVODSTVA published in Novosibirsk.

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## APPLICATIONS OF LASER TECHNOLOGY DISCUSSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 3-16

[Interview with V. F. Golubev, Doctor of Physico-Mathematical Sciences, Deputy Director for Scientific Work of the Scientific Research Center for Technological Lasers of the USSR Academy of Sciences, Winner of the USSR State Prize (Shatura, Moscow Oblast): "Overcoming Organizational Barriers"; first two paragraphs, EKO introduction]

[Text] The 27th CPSU Congress sets the task of providing under the 12th Five-Year Plan for extensive introduction of principally new technologies that make it possible to increase labor productivity many times over, to increase the effectiveness of the utilization of resources, and to reduce the energy- and material-intensiveness of production. The persistent implementation of these is the main path to intensification of the national economy.

How is their establishment proceeding? In Issue No 5 of EKO for 1986 we discussed problems of assimilating radiation technologies. In this issue we offer for the readers' attention a selection of articles devoted to laser technologies.

[Question] Vladimir Sergeyevich, first tell us, please, how do the organizations participating in the implementation of the comprehensive target program for the utilization of lasers in the national economy reach the goals earmarked by the 27th CPSU Congress in the area of principally new technologies?

[Answer] First of all, it is worth recalling that the possibilities of laser technologies, which today we plan as though they were something ordinary, were discovered quite recently. An outstanding role in their appearance belongs to the Soviet scientist Academician N. G. Basov and A. M. Prokhorov, who in 1952, simultaneously with the American scientists C. Townes, J. Gordon and H. Zeiger and the Canadian J. Weber and independently of one another, discovered the new principles of generation and amplification of superhigh frequency electromagnetic waves. This made it possible for N. G. Basov, A. M. Prokhorov and C. Townes somewhat later to arrive at the creation of new types of generators and amplifiers--lasers and masers--for which they were awarded the Nobel Prize in 1964.

The name "laser" is formed from the acronym of the English words which mean "light amplification by stimulated emission radiation." This is a quantum generator, a source of optical radiations which is characterized by a high level of directivity, a great density of energy and a depth of influence. It is not without reason that the laser beam is called a dagger beam.

Using a laser beam it is possible to cut and weld any materials, to carry out thermal hardening of parts, to make tape recordings and then reproduce music and text, to perform the most precise measurements, to carry out the most complicated methods of treatment and surgical operations, and to process data.

[Question] What are the basic directions being taken by the development of laser technologies in industry?

[Answer] The precise directivity and the high concentration of energy of the laser beam make it possible to achieve an effect where traditional production processes do not produce the desired result. With a laser beam it is possible to cut parts with a complex configuration with a precision down to the hundredths of a millimeter, to cut composite materials consisting of two or several layers of various materials, refractory metals and ceramic materials which do not submit to ordinary methods of cutting. Moreover the process takes place so quickly that the part does not have time to warm up significantly and the properties of the material in the cutting zone actually do not change and the parts are not deformed. The laser instrument is frequently used instead of a diamond instrument. It is much less expensive and in many cases replaces diamonds.

With laser welding there is no significant deformation either and the depth of boiling is great. The durability characteristics of these welded joints are several times greater, which is very important in key assemblies and aggregates, for example those operating under conditions of a chemically active environment. The productivity of laser welding is greater than the most progressive forms of automatic and semi-automatic welding by a factor of 5-8. In terms of quality it is just as good as electronic ray welding and, as distinct from it, it does not require the complicated and costly procedure of vacuuming or protection from X-ray radiation either.

In industry laser methods of processing lead to increasing the service life of items by a factor of 3-5, and in individual cases even 8-10 as compared to the traditional technologies, the service life of the parts increases severalfold, and high quality and precision of processing are guaranteed. They are excellent for use with remote control and therefore they can be the basis for flexible production systems.

There are gas, liquid and solid lasers and, depending on the conditions for operation, they have recurrent pulse and continuous action. The appearance of gas lasers made it possible to essentially increase their capacities both in recurrent pulse and in continuous operation. After that the path was opened up to extensive utilization of lasers in industry.

In our country research and development on laser technologies are being conducted in many directions. The largest projects are headed by academicians N. G. Basov, A. M. Prokhorov, Ye. P. Velikhov, Yu. A. Ishlinskiy, Corresponding Member of the USSR Academy of Sciences R. I. Soloukhin and Doctor of Sciences Yu. P. Rayzer. This is the solid scientific basis on which the target comprehensive program for laser technology was created under the 11th Five-Year Plan. It was to have led to their extensive application in machine-building, metallurgy, chemistry, medicine and other branches. In the program it was planned to conduct work in the following areas:

- a) development and creation of lasers for technological application;
- b) organization of series production of laser equipment;
- c) creation of experimental sections and laboratories at base enterprises and in scientific research institutes of branches in order to develop and introduce laser technological processes (such base laboratories and experimental sections were envisioned at the leading enterprises of many machine-building branches).

Several dozens of organizations, ministries and departments were to have participated in the implementation of the target program. The head ones were the USSR Academy of Sciences, the Ministry of the Electrical Equipment Industry and the Ministry of the Machine Tool and Tool-Building Industry. The Ministry of the Electrical Equipment Industry was to have arranged for series output of installations with capacities of 1 kilowatt and more for laser processing of materials and plasma spraying of powders. Other branches participated in the cooperation and in the batching of laser installations with their own units and sets of equipment.

For leadership of the work under the program an interdepartmental scientific and technical council was created, which included representatives of institutes of the USSR Academy of Sciences, the State Committee for Science and Technology, the ministries and the departments. The council formed a number of sections which joined together specialists in particular areas of laser equipment, for example, sections for solid lasers, laser technology in machine building, laser medicine and so forth.

The past 5 years have been characterized both by certain successes in the area of research and development on technology and equipment and by many disappointments related to the difficulties in realizing the scientific results in industry. A number of developments carried out in our country in terms of principles of effect and effectiveness are just as good as foreign ones and sometimes they surpassed them. For example, recurrent pulse lasers were first created in the USSR. One can mention the interesting research and development carried out in the Physics Institute imeni P. N. Lebedev, the Institute of Problems of Mechanics of the USSR Academy of Sciences, the Institute of Theoretical and Applied Mechanics of the Siberian Branch of the USSR Academy of Sciences, the Institute of Atomic Energy imeni I. B. Kurchatov and others, and also in the Scientific Research Institute for Technological Lasers under the USSR Academy of Sciences. The center devotes a good deal of attention to contacts with industry and preparing it for the production of

laser equipment and the assimilation of laser technology. To this end it has developed several base laboratories, including one at ZIL which EKO has already written about [Footnote 1].

In the production of laser equipment the implementation of points of the program that are of an intrabranch nature proceeded better than others. Certain ministries arranged their own production of industrial laser installations and provided them not only for their own needs, but also for other branches when they managed to submit their orders. But this was not specialized series production with all the advantages that follow from it. When the order is filled by way of rendering assistance, out of kindness, and not according to the plan, it is difficult to place demands on the manufacturer with respect to deadlines, technical parameters and the quality of the items. For there are no previously established conditions for deliveries and requirements. If something does not turn out right the consumer can only blame himself. But even under these conditions not all who wanted to could order laser equipment. Moreover, not everyone knows that it is produced at all, who produces it or where to apply. These are very serious impeding factors, and they are not organizational, but also they have to do with content: the consumer does not have the possibility of influencing the level of equipment that is offered. Consequently, the development of its technical characteristics and improvement of its quality are impeded.

The progress has been much less in the Ministry of the Electrical Equipment Industry. In essence, the branch has not fulfilled the assignment set for it under the 11th Five-Year Plan for the organization of series production of laser installations with capacities of 1 kilowatt and more. The experimental batch of these installations using the developments of the Institute of Theoretical and Applied Mechanics of the Siberian Branch of the USSR Academy of Sciences was manufactured by the Novosibirsk Sibelektroterm Association, but series production was never organized. In certain other cases the developments were not brought to the point of series production either.

[Question] What, in your opinion, stood in the way, if interesting developments had already been carried out?

[Answer] It seems to me that first of all it was the sluggishness in planning and designing. Because of this there was a large time lag between scientific research and the practice of its embodiment. The chain from the scientific idea to its implementation was not closed. The design organizations of the Ministry of the Electrical Equipment Industry--the All-Union Scientific Research Institute of Electrothermal Equipment and the All-Union Scientific Research Institute of Electric Welding Equipment--which were assigned the tasks of planning and designing the installations, were in no hurry to carry them out and try to conduct the work with small forces. In various years of the five-year plan, from 15 to 20 people engaged in work with laser equipment here. No specialized design subdivisions were created.

The second reason was that no particular enterprises specialized in the manufacture of laser equipment. The third and no less important one was that duties were carried out poorly by those branches and departments which were to have provided for cooperation and batching of laser installations, for

instance, the Ministry of Petroleum and Chemical Machine Building for Compressors, the Ministry of the Machine Tool and Tool-Building Industry--for hydraulics and crossbar tables, others--for optics and means of automation, and so forth. All this led to a situation where, although during the years of the past five-year plan fairly good results had been accumulated in physics research and the development of theoretical fundamentals of laser technology, the scope of their application in production turned out to be inadequate.

It assumed that the next step forward on the organizational plane will be the interbranch scientific and technical complexes (MNTK) that are being created. Being the head organizations for large scientific and technical problems, they should provide for conducting and coordinating fundamental and applied research, experimental-design and planning work, the manufacture of experimental models of technical equipment and, along with the ministries and departments, the development of these models to the point of series production. They are responsible for drawing up programs and plans for the most important research and development and for the creation of experimental models. Such an MNTK has been created for laser technologies in industry.

[Question] What organizations have been included in the MNTK for lasers?

[Answer] The head organization of the complex is the NITsTLAN. From the Academy of Sciences the complex includes also the Institute of General Physics, the Physics Institute imeni P. N. Lebedev and the Institute of Problems of Mechanics. From the Ministry of the Electrical Equipment Industry, scientific research and planning-design institutes for electrothermal equipment and electrical welding equipment, and the Tbilisi Plant for Electrical Welding Equipment. Sibelektroterm (Novosibirsk), the Induktor Plant and several others will participate in the work of the MNTK.

[Question] Thus there are organizations that are carrying out fundamental research, applied developments and production. Is the chain from the idea to introduction closed, then? Can one assume that many obstacles and barriers will be removed?

[Answer] From the outside everything looks as though one could be quite optimistic, but we have no feeling of complete satisfaction on the inside. First of all, the status of the complex is still unclear. The organizational separation has not been eliminated. Applied institutes and production associations are administratively under the jurisdiction of their own ministries. Not a single one of the associations is specializing in the output of laser installations. Only a small proportion of their collectives will engage in the fulfillment of assignments for laser equipment. And we have already "gone through" all this under the 11th Five-Year Plan and have not seen anything good come of it. The complex has no unified financial and material funds. It would be difficult to adhere to unified principles of payment and incentives for labor.

[Question] How will the MNTK contribute to the implementation of the laser program by other organizations? For example, the Institute of Theoretical and Applied Mechanics of the Siberian Branch of the USSR Academy of Sciences and the republic academies?

[Answer] It is envisioned that, in addition to the organizations "included" in the MNTK and also those "participating in its work," there will be those who "cooperate" with it. This is the way they have envisioned the development of the interrelations with the Institute of Theoretical and Applied Mechanics of the Siberian Branch of the USSR Academy of Sciences and several others.

[Question] You will agree that it is not very clear how this will look in reality. It is not easy to imagine how the Sibelektroterm Association will manage to begin series production of laser installation of the institute from whose plans it has created experimental models. For must one not doubt that a sufficiently large portfolio of orders for developments of organizations "included" in the MNTK has been prepared for Sibelektroterm.

[Answer] Yes, not everything has been clarified yet. The statement of the problem concerning regional laser centers is correct and attractive. We know that attempts are being made to create them in Novosibirsk on the basis of the Siberian branch of the Academy of Sciences, in Kuytyshev at the branch of the Physics Institute of the USSR Academy of Sciences, and in Vilnyus at institutes of a physics profile of the Lithuanian SSR Academy of Sciences. This idea has its undoubted advantages. Regional centers can become not only creators of laser equipment and technology, but they can also actively carry out its production in various regions of the country.

[Question] In the history of Soviet technology we have already repeatedly tested models of the kind of organization where, under the aegis of an academic institute, we have combined scientific, engineering and production forces that are advancing in a new scientific and technical direction. For example, such a model was used to join together the development of cryogenics equipment in our country when, at the end of the 1930's and beginning of the 1940's, this direction was headed by the Institute of Physics Problems of the Academy of Sciences whose director was Academician Petr Leonidovich Kapitsa. But at that time, after a certain period of searching, we still resorted to the creation of a specialized design bureau and then an experimental testing bureau and later a specialized series plant. When the matter was expanded in breadth and depth it was necessary to organize new branch institutes and plants. Do you think that the organizational measures that are now being undertaken will be sufficient?

[Answer] Undoubtedly, the creation of an interbranch scientific and technical complex headed by an academic organization provides more extensive possibilities for the development of principally new technologies and kinds of equipment, increases the role of the Academy of Sciences as a coordinator of scientific and technical programs, and increases its responsibility for the creation of theoretical foundations for principally new scientific and technical directions, as a result of which it is possible to increase labor productivity and the effectiveness of production not by percentage points but by hundreds of percentage points. This is precisely the task set for academic science in the Basic Directions for the Economic and Social Development of the USSR During 1986-1990 and the Period Up to the Year 2000. Therefore the search for effective forms of integration of science and production should be even more active. So far there is a good deal that is unclear and complicated

in the MTK. It will have to travel the difficult path of organizational perfection. The Leningrad Svetlana Scientific-Production Complex is presented in EKO No 9 for 1985. As its general director, Hero of Socialist Labor O. V. Filatov [Footnote 2] writes, this NPO has strictly determined ratios between scientific and production subdivisions which carry out in a planned way the entire cycle of the creation and assimilation of new items, including scientific research and experimental design work, and experimental and series production. This is quite correct. It is necessary to have proportionality and balance in all cycles, from research to the introduction into production of the technology that has been created on its basis. When within the framework of the scientific and technical complex science and developers predominate and the production base is inadequate, this is bad. In the MNTK, as is quite obvious by now, the scientific part is still much stronger than the production part.

You reminded me of Academician P. L. Kapitsa. He himself was a great engineer and was very enthusiastic in providing leadership of the engineering subdivision created within the framework of Glavkislorod, which he organized. Within the framework of the MNTK scientists will have to delve more deeply into engineering problems and, on the other hand, will have to become familiar with the interpretation of scientific ideas by design and technological organizations. That is, there will be a process of mutual professional enrichment, without which true integration of science and production is unthinkable.

Is one scientific and technical complex for lasers enough to solve all the problems? I do not think so. The MNTK is only the beginning. It is necessary to develop regional centers and a network of series productions which will reproduce laser equipment. Judging from foreign experience, laser technologies are occupying an ever larger position in industry. In machine building in the United States, according to predictions, they will reach the level of 10 percent of the value of all machine-building technologies. In our country too orders for them are increasing each year. The Ministry of the Electrical Equipment industry is not satisfying the demand for large gas lasers for cutting, welding and thermal processing. The consumers have to manufacture them themselves, particularly, the Ministry of the Shipbuilding Industry, the Ministry of the Aviation Industry, the Ministry of the Automotive Industry and other branches.

We must not remain silent about how slowly they are constructing the head subdivision of the MNTK--the scientific research center for technological lasers. In February 1986 only its first section had been put into operation, while previously it was thought that all of the construction was to be completed under the 11th Five-Year Plan. Bulgaria has taken a different path. There, in order to gain time, they have not waited until the construction has been completed. First they vacated a five-story building and assigned it for the scientific laser complex and equipped it, and new production areas were being constructed at the same time. And when they were put into operation they had already mastered the output of industrial laser installations and begun their series production. Our enterprises are glad to get hold of them.

[Question] And what is being done to eliminate the difficulties in cooperation and batching? Will it be possible to take care of this within the framework of the MNTK?

[Answer] I sincerely doubt it. It is impossible to include in the MNTK all subdivisions on which the creation of laser equipment depends. True, certain ministries have agreed to begin deliveries (the Ministry of Chemical and Petroleum Machine Building and the Ministry of Instrument Making, Automation Equipment and Control Systems), but a member of other participants and associated organizations have not made any apparent attempts to meet them halfway in the cooperation.

[Question] Which problems and cooperation are the most critical?

[Answer] One of the most complicated technical problems is optics. Optical items cannot be produced in just any production. They must have specialized enterprises that are equipped with certain equipment and have experience and a certain level of technical culture.

The laser can be effective only when there are no periods of down time or losses of capacities when preparing to perform production operations. Then the advantages of laser equipment increase many times over. Therefore an immense role is also played by automation of control of laser devices. They are speaking about creating automated and robotized flexible production laser systems. So far it is not clear who will supply the laser equipment with computers and means of automation. The Ministry of Instrument Making, Control Systems and Automation Equipment has indicated its readiness, but the Ministry of the Electronics Industry is not very willing to deliver elements for means of automation.

[Question] The changeover to the new conditions for management of many machine-building industries beginning in 1986 should change the situation with respect to the fulfillment of orders and contractual commitments.

[Answer] Yes, the economic levers should exert a favorable influence on the other participants. But this is only if they have accepted orders and included them in the plan. But there are all kinds of obstacles here. And the manufacturer sometimes does not wish to accept the order, and for some reason nobody forces him to. The fulfillment of assignments under target programs has not become mandatory and planned. In these situations, of course, it is impossible to apply official sanctions for the violation of deadlines for the fulfillment of contractual commitments. The Gosplan and the State Committee for Science and Technology must immediately make a decision concerning planning cooperation for laser equipment. But in principle it is necessary to state the problem more broadly--the fulfillment of assignments under target programs.

[Question] Every new scientific and technical area requires specially trained personnel. How prepared are the enterprises for the assimilation of laser technologies?

[Answer] Indeed, in order to carry out these quite special technological processes it is necessary to have fairly profound knowledge in the areas of laser physics and methods of measurement and the interaction between the laser beam and the materials. A large place is occupied by the training of personnel in work at the NITsTLAN. Along with the Moscow Higher Technical School imeni N. E. Bauman, it has organized training of engineers in the new specialties. The base laboratories and experimental sections created by the center along with the branches are also outposts for the study of laser methods and their practical application.

A large amount of work for publicizing laser technologies and training could be carried out by regional laser centers. In general, it seems to me that a network of regional centers could essentially augment and improve the organizational structures necessary for effective dissemination of new technologies and contribute to overcoming the departmental and territorial barriers. The consolidation of scientific and engineering forces in the MNTK and in the local areas and their combined actions are necessary conditions for successful implementation of the tasks set by the 27th CPSU Congress for radically transforming the material and technical base of Soviet industry.

#### FOOTNOTES

1. Academician Ye. P. Velikov, "An Important Element of the Country's Scientific and Technical Structure," EKO, No 10, 1982.
2. O. V. Filatov, "On the Agenda--Scientific Production Complexes," EKO, No 9, 1985.

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## HOLE PLAYED BY LICENSES DISCUSSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 16-21

[Article by Yu. N. Dubnishchev, candidate of technical sciences, Institute of Automation and Electrometry of the Siberian Branch of the USSR Academy of Sciences (Novosibirsk): "Why Have Licenses When We Have Our Own Developments?"]

[Text] In the autumn of 1980 we, a group of developers of laser anemometers, instruments for determining the speed of flows of liquids and gases, on invitation from the Karl Zeiss Jena Combine (JDR), participated in a trade and industrial exhibition of this firm in Tbilisi, since the exhibits included a Doppler navigator LADO-2, created by our institute in conjunction with this combine.

We created the first laser Doppler navigator (LDIS) in an instrument as early as 1974. During that same year, practically simultaneously with the appearance of the Western analogues, one of the Novosibirsk plant produced several experimental models of an instrument with our design. Additionally, the institute created other types of measurement systems for various specific applications. Our cooperation with the Karl Zeiss Jena Combine began in 1975. Our successful experience in joint work and the favorable market conditions led the combine and the institute to a decision concerning the development of the LADO-2 model of instruments for series output. The Karl Zeiss Jena Combine in 1981-1982 produced about 20 of these instruments (without a signal processing block), a large proportion of which were delivered to the Soviet Union.

And at the exhibit in Tbilisi our attention was attracted to two young people who spent a long time getting acquainted with the operation of the instrument displayed on the stand, displaying clearly more than just idle interest in it. We went up to them and started talking. The young people turned out to be workers of the Tbilisi Takhometriya Special Design Bureau of the USSR Ministry of Instrument Making, automation equipment and control systems. They invited us to their bureau and when we were visiting them they told us a surprising and sad story. It turns out that the Ministry of Instrument Making, Automation Equipment and Control Systems in 1976 acquired from the FRG a license for a laser instrument for measuring the speed of hot rolling of

metal. For several hundred thousand marks the purchaser received a mockup of the measurement device with a spare set of lasers. The assimilation of the license was assigned to the Tbilisi Special Design Bureau, which had no experience in the creation of systems of this kind. The attempt to translate the mockup they had acquired onto the domestic element base without the proper critical analysis of the system and the necessary ideas about the essence of its operation was not successful. It was not hard to convince us of this, having become familiar with the existing hybrid mockup.

Nonetheless, the story about the license ended up "quite favorably." Of course, they found reasons why the development could not be realized within the given time period: the impossibility of selecting a precise analogue of the laser, the lack of precise domestic analogues for optical and electronic elements of the system. And the appeals from the developers to industrial enterprises for unit output of these analogues for experimental models, of course, were rejected as economically absurd.

One is struck by the fact that the specialists of the Tbilisi Design Bureau, like the officials who sanction the purchase of the license, did nothing to learn about the condition of the developments and obtain advice on corresponding laser measurement systems in our own country where work has been in progress in several institutes of the USSR Academy of Sciences since the end of the 1960's, and there are priority results which are recognized in the country and abroad. We have also published the first monograph in the world entitled "Laser Doppler Navigators," which analyzes in detail the method of measurement and gives the corresponding system solutions, including the system for which the ill-fated license was purchased in 1976. This was another repetition of the routine, but economically wasteful situation in which we are unaware of what is going on in our own country. But when we were in Tbilisi we got an idea of how important it is to introduce optical methods of measurement into the technology of metal rolling production.

In 1981, within the framework of the program for intensification of the introduction of scientific developments of scientists of the Siberian Branch of the USSR Academy of Sciences, which was created on the initiative of the Novosibirsk CPSU Obkom, the Institute accepted the topic entitled "The Creation of a Laser Doppler Navigator for Type Rolling" for the Novosibirsk Metallurgical Plant imeni A. N. Kuzmin. The work was conducted through the efforts of two subdivisions of the Institute: the first developed an optical measurement device and the second engaged in the creation of an electron clock for processing the signal. The work was conducted within the framework of an economic agreement with the plant and was carried out in two stages. Initially, they created a working laboratory mockup of the instrument and tested it under shop conditions using a real pipe rolling mill. From the results of the tests we adjusted the design documentation and manufactured an experimental model of the measurement device.

In January 1984 a working model of the instrument was installed directly on the reduction mill of the electric pipe welding shop of the Novosibirsk Metallurgical Plant imeni A. N. Kuzmin. It has been functioning successfully since then, making remote measurements of the speed and length of the hot pipes from a distance of 1.5 meters. The meter has high precision and

functions at the same rate as the technological process for rolling. It was not until a year after our instrument had been put into operation that an article appeared in one of the scientific journals in the United States with a description of a laboratory mockup that had similar characteristics to the measurement device and a discussion of the possibilities of applying it in metallurgical technology.

The workers and operators who run the machines initially were quite skeptical about the instrument and were even on their guard. But after there appeared before the operator two numerical indicators, one of which indicated the speed of the pipe and the other the length of the measured cut, which significantly facilitated the adjustment of the machine tool and the direct control of the process of rolling, one of the operators told the developers, pointing to the indicators: "You have made a useful thing here, and everything that was previously installed around the machine tool can now be taken away...."

The creation of an instrument for measuring the speed of rolling and its successful operation under the conditions of metallurgical production were fairly widely advertised on Central and Novosibirsk television and in the newspapers. The institute and the plant received a flood of letters and requests from various interested organizations. They all amounted basically to a request for manufacturing a model of the instrument for a given specific consumer. That is, it was quite obvious that it was necessary to develop industrial production of the item. The USSR Gosplan recommended the development to a number of ministries to industrial assimilation. In particular, one of these ministries was the USSR Ministry of Instrument Making, Automation Equipment and Control Systems, and this gave us a certain amount of hope. The ministry suggested to the Soyuzanalitpribor Production Association, which includes the Tbilisi Takhometriya Special Design Bureau with which we are familiar, to find out about the instrument and find out about the possibility of performing experimental design work and preparing technical documentation to be transferred to the manufacturing plant. The Tbilisi workers visited the Novosibirsk Metallurgical Plant (NMZ) and our institute, and came to an agreement concerning joint work between the institute and the special design bureau.

It seemed that things had gotten off the ground and the metallurgical industry would finally receive an instrument which was extremely necessary for technical reequipment of the branch. To be sure, we were suspicious of the fact that the Ministry of Ferrous Metallurgy remained silent, although the directorate of one of the leading research institutes of this department, the All-Union Institute of Automation of Ferrous Metallurgy, had been familiar with the development since the summer of 1984. But even up to this point the interested departments had not defined a need for instruments of this type.

In assimilating the production of principally new technical equipment, one should also keep in mind such an economic category as lost advantage. The plant now delivers pipes of standard sizes. If the consumer needs pipes that are somewhat shorter, it cuts them to the necessary length and a considerable proportion of the metal goes to scraps. Equipping the rolling mills with laser meters of speed and length would make it possible for the plants to produce pipes of the necessary length on request from the clients and at the

same time save a large quantity of metal. Another channel for economizing on metal when using the instrument would be optimization of the technological process for rolling and reduction of losses during readjustment of the machine tool from one assortment of items to another.

Of course it is simpler to purchase a license for "turnkey" instruments, machines or plants, but "I Spy" games in foreign trade can lead to regularly lagging behind the world level of technology. There is no cause to hope that in economic competition our competitors will provide us with the most advanced technology. They are interested in a stable sales market for middle-level technologies with all the political and economic advantages that ensue from this.

For us the principle, "saving a drowning man is a matter for the hands of the drowning man himself" has long for creators of new technical equipment the only possible principle for operation if they want to see their brainchild in action. They have to do everything that is required of them. And more and more is being required of them. Thus the Takhometriya Special Design Bureau announced that it could take on the job of the experimental design work for the instrument but under the condition that the institute would take responsibility for the coordination (no more and no less!) of enterprises of various ministries for providing the element base for the experimental design development and industrial output of the item.

The instrument has been in operation in the NMZ shop for about 2 years already. The plant goes to the institute with requests to manufacture laser measurement devices for other machine tools. It estimates its demand at at least 20 instruments (and this is an average plant for the branch!).

Supplying instruments for these types of machine tools that are in operation would already produce a considerable savings and, the main thing, would contribute to the priority of product quality over quantity. And for machine tools of the next generation that are being designed with an automated technological process, these instruments are simply necessary, since any supermodern control computer will be an expensive and nonproductive toy unless it has modern meters of a proper quality and initial transformers which, as of today, are laser meters of speed and length.

With the development of an element base the cost and sizes of these meters will decrease rapidly. Even now we have an operating mockup which in conjunction with the planning organization we could bring to a condition where the low cost and its small sizes would make it economically advantageous to install such a meter in every rolling mill section. Miniaturization is achieved as a result of making the instrument on the basis of a semiconductor laser with elements of integrated optics and a block for processing the signal on a single integrated circuit. This meter works well with the microprocessor control system.

Such an instrument could find the broadest application not only in metallurgy, but also in the pulp and paper and glass industries, and other branches, which is confirmed by the letters of request from these branches. But the academic institute cannot reproduce these instruments. It has a different task: to

search for new methods, to create operating models, to demonstrate the possibilities of the new devices and to contribute to industrial assimilation of its development under the conditions of working in close contact with the planning organization. To require it to reproduce the instruments and thus neutralize the inertia of the planning organizations and series-production enterprises is the same thing as forcing an army intelligence unit into open battle in order to take a "nameless" hill: the tactical problem may be solved, but the strategic loss is inevitable.

And here on a table in the laboratory is an operating model of an instrument of tomorrow. What will be its destiny? There are plenty of people who want the instrument. The one with the most initiative and persistence is our tried and true client--the Novosibirsk Metallurgical Plant im ni A. N. Kuzmin. But this is no solution to the problem for the national economy as a whole. We need a partner in industrial assimilation of the instrument, and the NMZ in the scientific and technical structure of such a partnership would occupy a position that would be advantageous to the cause and to itself as a testing ground for industrial testing of new models. If we could find a partner for manufacturing there would be a triad which would have the capability of effectively solving problems related to the application of advanced measurement equipment.

Because of red tape we could be too late and then the customary situation would follow in which it is much simpler to spend currency than to apply our efforts to organizing production. We have the example in front of us: while the USSR has effective developments of laser anemometers, instruments manufactured abroad are being purchased at prices of \$90,000-160,000. This kind of economic extravagance can lead to forfeiting positions in technology.

The positive changes in the structure of interrelations between science and industrial production that have been noted recently should preclude the possibility of such situations arising.

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## ROLE OF SPECIALISTS IN LASER WORK DESCRIBED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 22-24

[Article by F. V. Lebedev, doctor of physico-mathematical sciences, chief of the section for laser technology of the Institute of Atomic Energy imeni I. V. Kurchatov (Moscow): "Two Pillars of Hope"; first paragraph, EKO introduction]

[Text] We have requested that researcher-developers, manufacturers and consumers of laser equipment and specialists in economics and management express their viewpoint: what, in their opinion, is holding up the development of laser technology and what must be done to assimilate it effectively? We are publishing their answers.

The unique energy characteristics and the simplicity of control of a laser beam--these are the two essential pillars on which laser technologies rest. And these are two pillars of our hope that these technologies will make their way into production. But it is necessary to approach them very carefully and cautiously as a means of processing materials, and then they will manifest their immense merits and there will be no disenchantment, which frequently comes in those cases when people grab onto some new innovation without being fully aware of what it is needed for.

There is no point in using laser processes to replace modern automated processes of welding parts on which we have not placed special requirements for precision and durability. The laser should be used in places where principally new technological possibilities are required and where people want to obtain items with special characteristics.

The same thing can be said about cutting, thermal hardening and the application of protective coatings. The cutting of steel in shipbuilding, especially thin sheet steel when it is necessary to obtain parts with complex configurations and not violate the structure of the material in the cutting zone is a sphere of effective application of the forces of the laser beam. The high productivity of the laser installation, which operates automatically according to a program, will be combined here with the special precision of cutting and the lack of deformation of material that is being processed.

New possibilities are also being opened up by the utilization of lasers in selective processes. A laser beam lies in a narrow range of wavelengths. And, as we know, molecules and atoms in a gaseous condition absorb radiation also in narrow spectral intervals and these intervals differ from one another for different substances. If one were to select the length of the laser wave in such a way that it would absorb only the necessary kind of molecules the radiation would act selectively. This makes it possible to perform technological operations of separating and purifying substances. The utilization of a laser for these purposes can turn out to be very advantageous.

When considering the expediency of the introduction of laser technology, it is necessary to determine the extent to which it will fit into existing production. The truth seems simple and it is even somehow awkward to recall it. Nonetheless disenchantment with new technology can also come from here.

I hope that my words will not be perceived as an attempt to drive the consumer away from new technical equipment. I hope that they will understand me correctly when I say that principally new technologies require a competent approach and a sober attitude from the standpoint of both their technical and economic capabilities, for then and only then will they play their revolutionizing role in the acceleration of scientific and technical progress. For we have already experienced one laser "boom" at the beginning of the 1970's, after which there was a certain decline and loss of interest in laser technologies. We have now managed to advance incomparably further in research and development. It is necessary to approach their utilization with open eyes and then it will be effective.

Many problems in laser technology are related to the shortage of the technological lasers themselves, especially lasers with increased capacity--more than one kilowatt--which are manufactured in the form of specialized or universal technological laser sets. So far we do not have these sets. All of the interesting industrial introductions of powerful lasers are based on experimental models manufactured either in a single copy or in the form of small series. This new technical equipment is manufactured according to one-time technology in experimental shops or experimental sections. It would be difficult to expect a good economic effect from such a situation.

One would like to hope that this situation will change radically as a result of the creation of an interbranch scientific and technical complex headed by the scientific research center for technological lasers of the USSR Academy of Sciences. This organization should not only coordinate the development of equipment and technology for laser processing of materials, but also operationally utilize the latest achievements of laser science that have been developed successfully in the leading institutes of our country. Unfortunately, there are still many problems here. For example, in the Institute of Atomic Energy at the end of the 1970's they studied and proposed a new method of exciting rapid flow gas lasers: a charge of alternating current of a sonar range of frequencies that makes it possible to simplify the system of feeding and increase the efficiency of lasers by a factor of 2-3. This method of excitement found response in Japan, the FRG and the United States, but so far it has not been used in the USSR.

Finally, there is another problem that must be solved in order to count on the success of laser technology--the training of special personnel. Now specialists in "equipment and technology of laser processing of materials" are graduated only by the faculty for retraining of the MVTU imeni N. E. Bauman and the evening division. The time has come to train engineers who are laser technologists in day divisions of VUZes as well.

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## NEED FOR LASER SERVICES ANTICIPATED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 24-26

[Article by N. T. Savrukov, candidate of economic sciences, head of the Department of Economics and Organization of Production of the Chuvash State University (Cheboksary): "Immediately Concerned About Service Functions"]

[Text] Recent years have been marked by considerable expansion of the sphere of utilization of laser equipment and technology. In industry laser technologies are being introduced most successfully at the Moscow Automotive Plants ZIL and imni Leninskiy Komsomol, the Cherepovets Metallurgical Plant, the Tulachermet Scientific Production Association, and in our autonomous republic--at the Cheboksary Plant for Industrial Tractors and in Leningrad--at the Baltiyskiy Plant, and so forth. In medicine laser equipment and the Skalpel and Rozashka-1 instruments are being used actively in surgery, the OKA-2--in ophthalmology, the Razbor--in oncology, the Yagoda--in therapy, and so forth.

The interbranch of laser technology requires an organizational community of efforts of researchers, developers and manufacturers. Practice has repeatedly shown that in places when assimilating new interbranch technologies there arise on the basis of fundamental research they have achieved a unity of scientific, design and production forces, good results have appeared as, for example, in the Institute of Electric Welding imeni Ye. O. Paton of the Ukrainian SSR Academy of Sciences. Organizational community guarantees responsibility for all stages of the chain from the idea to the introduction.

In our opinion, even today it is crucial to create an all-union scientific production association for laser technology (VNPOLT) which could conduct applied research and development, manufacture laser equipment, and provide all necessary forms of service for the consumers. Will the volume of work be sufficient to justify the creation of an independent all-union scientific production association? In order to answer this question one can present data concerning the volume of sales of laser equipment in economically developed countries. The total sales volume in the United States had increased in 1984 by a factor of 1.8 as compared to 1978.

At the present time the interbranch scientific and technical base is the NITsTLAN--the Scientific Research Center for Technological Lasers of the USSR Academy of Sciences. Unfortunately, its capacities are not developing at adequate rates and it is not responsible for all questions of development, production, introduction and improvement of the reliability and quality of laser equipment. Nobody is conducting series production yet. Nonetheless the first stage in the establishment of laser equipment--the creation of a scientific and training-methodological center for lasers--is being carried out more successfully thanks to the NITsTLAN. It seems to us that in addition to this it would be expedient to organize branch regional centers for laser technology which will be included in the all-union organizational structure that is responsible for laser equipment in the country--the VNPOLT.

The organization of the VNPOLT should culminate with the creation of series production which will provide for industrial output of the necessary kinds of equipment and also services for consulting with consumers, technical service, repair and rental of laser equipment. And all these service functions should develop along with the creation of the VNPOLT in order to prepare consumers for assimilation of principally new technology. To do this the association should include divisions for consulting, technical service and repair, and rental of laser equipment.

In the production part of the VNPOLT it would be expedient to include, in addition to plants for series manufacture of laser equipment, also certain enterprises that produce batching equipment--optics, measurement equipment and crossbar tables. And, in addition to the equipment itself, each plant should also produce replacement parts for it. Why is it necessary to have a plant for manufacturing optics for laser equipment in the association that is being considered? The need for it is dictated by the special significance of the quality of all optical elements and the large volume of work in optics for the needs of labor equipment. It is optics that is the stumbling block today. It has turned out to be quite impossible to organize cooperative delivery of optical equipment.

The scientific and technical guidance of all the work on laser equipment should be provided by a general designer who will be deputy general director of the VNPOLT. It is necessary to introduce also the status of head designers for the various areas of work: equipment, technology and materials. The head designer for technology, for example, will combine all the work being done in the country for disclosing new possibilities of industrial application of laser equipment. Thus the VNPOLT will not only prepare technical documentation for series production plants, but also support a sphere of application for laser equipment.

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## SPECIALIZATION IN LASER PRODUCTION ENCOURAGED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 27-29

[Article by V. G. Zavyalov, general director of the Sibelektroterm Production Association, and A. G. Pomeshchikov, head engineer of the special design bureau of the Sibelektroterm Production Association, candidate of technical sciences: "Creating Specialized Capacities"]

[Text] The Basic Directions for the Economic and Social Development of the USSR During 1986-1990 and the Period Up to the Year 2000 set for the USSR Ministry of the Electrical Equipment Industry the task of mastering series output of laser technological installations (LTU) with the capacity of radiation of up to 10 kilowatts. They make it possible to weld pipelines and crankshafts for motor vehicles, to cut composition and superhard alloys and ceramic materials, and to conduct thermal processing of various surfaces of parts, which increases their hardness and resistance to wear and tear. When processing with a laser beam there is less deformation of the items and final mechanical processing of surfaces is reduced or even eliminated completely. It becomes possible to process parts with complicated forms and also to harden parts in places that are difficult to reach, which is impossible with the existing technology for thermal processing.

In solving this national economic problem an important place is allotted to our association. On the basis of scientific developments of the Institute of Theoretical and Applied Mechanics (ITPM) of the Siberian Branch of the USSR Academy of Sciences (with the participation of the All-Union Scientific Research Institute of Electrothermal Equipment) we are conducting a large amount of work for the creation and further improvement of LTU's. We have already manufactured seven LTU's which are in operation both in scientific research institutes and at industrial enterprises. This approach to new equipment is probably the most correct since it makes it possible for the developers and the manufacturers to check the effectiveness and the reliability of new items, including under conditions of industrial operation, and also to determine ways of further improving them.

It seems to us that we have been lucky with our co-workers. The Institute of Theoretical and Applied Mechanics reacts sensitively to our slightest remark. If one could say about the first variant of the design that it was not

technological, the second variant, on which we were working on 1984, was completely prepared for industrial assimilation. It is also valuable that the ITPM formulated the requirements for the installation which could serve as a methodological guide both for the manufacturer and for the consumer.

The work in the association for creating and introducing laser technological installations is fraught with very great difficulties. The reason for these is that the head plant of the association specializes in the manufacture of large electrometric equipment with sizes in the dozens of meters and weights in the hundreds of tons.

We have gigantic bays for shops, large gantry cranes and immense parts. And laser equipment requires fine, delicate handling. There is an altogether different psychology and ideology of their production and their material embodiment. It is necessary to have different production skills, precision equipment and premises of much smaller sizes where even overhead track hoists would be quite adequate.

The shops for basic production have practically not participated in the manufacture of LTU's. The future demand of the national economy for LTU's for thermal processing, toward which our association is oriented, can be satisfied only with the creation of a specialized production. It must meet the requirements for the manufacture of items of precision mechanics, vacuum technology, testing of high-voltage equipment, the "Sanitary Norms and Rules of the USSR Ministry of Health for Construction and Operation of Lasers," taking into account cooperation in the manufacture of optics, and also deliveries by specialized plants of energy sources, microprocessor systems for control and manipulators (crossbar tables with numerical program control). If it is envisioned to have power sources and optics manufactured by specialist plants, the creation within the Sibelektroterm Association of a specialized production base for the manufacture of LTU's remains problematical.

An interbranch scientific and technical complex called "technological lasers" was created in 1976. Our association participates in it as a manufacturer of LTU's. Through joint instructions from the USSR Academy of Sciences and the Ministry of the Electrical Equipment Industry it is prescribed that we create a specialized production for producing elements of laser equipment and laser technological complexes, beginning in 1987. It is necessary to rush the planning and construction of the production physical plant for these purposes, and this does not depend on us.

The association has a powerful production base whose utilization for the manufacture of lasers will cost the state considerably less than the construction of new plants, as is envisioned by the Ministry of the Electrical Equipment Industry. Moreover, the development of production areas will make it possible to organize the manufacture of industrial accelerators for radiation technologies on the basis of developments of the Institute of Nuclear Physics of the Siberian Branch of the USSR Academy of Sciences; to increase the volume of large electrothermal equipment for ferrous and nonferrous metallurgy and other branches of the national economy; and to expand the experimental and design-technological base of the association's special design bureau.

There is a very real possibility of accelerating the creation of specialized capacities. Next to our association is a construction site of the institute and an experimental testing production for it. The institute will have to develop new technologies for ferrous metallurgy and develop equipment for them. When a large production association with a strong design bureau has been operating right next door for many years, and they are working on similar problems, it is quite incomprehensible why this is done separately and not as a part of this association, and it is necessary to create a new organizational structure. The institute's director also thinks that it will be expedient for the institute to join the association and create there a strong scientific center which would also include the Sibelektroterm Special Design Bureau. Then it would be possible to achieve a return more quickly and to assimilate laser and radiation technologies.

Another important task is to create a comprehensive engineering service for laser technological installations whose tasks should include design development of LTU systems, including systems for control using microprocessors and manipulators; developments of nontraditional technologies for manufacture LTU's (instrument level) and testing during the process of manufacture; experimental development of all LTU systems for purposes of further improvement; experimental development of the technology of laser hardening; the introduction of LTU's at the location of the consumer with training of operations personnel, and so forth.

Today all these jobs are done in parallel with work on the basic products list of the association, by the same specialists and, of course, in considerably smaller volumes.

The creation of such a service is being impeded by the strict limit on the wage fund (the Ministry of the Electrical Equipment Industry has refused to allot a special purpose wage fund) and also the great shortage of engineering personnel in Siberia.

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## EXPANDING APPLICATION OF LASERS DISCUSSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 30-33

[Article by B. F. Mulchenko, candidate of physicomathematical sciences, chief of the Laboratory for Laser Technology of the Scientific Research Institute of Technology of the Automotive Industry, and M. M. Fishkis, head welder of the ZIL, candidate of technical sciences (Moscow): "Assistance in Advancing This Instrument That Knows No Wear and Tear"]

[Text] Enterprises of the Ministry of the Automotive Industry are already among the largest consumers of laser technology and in the future methods of processing with the laser beam will occupy a leading position in the branch technological arsenal. Indeed, how can one process ceramic parts of engines, glass reinforced plastic for cabs, reinforced cast pieces and multilayer, composite materials? The traditional technologies are ineffective here, but the laser beam cuts these materials easily and simply, like any knife, even the dullest one, cuts soft chocolate candy.

Now in the automotive industry laser technology for thermal hardening is most widely used. At ZIL, for example, the first automated laser line in domestic machine building is being used for thermal hardening of aluminum heads of cylinder blocks of engines. A number of plants are assimilating comprehensive technology for using the laser beam for thermal hardening of parts of trucks, and at the Moscow Automotive Plant imeni Leninskiy Komsomol, laser beams are used for thermal hardening of important iron parts.

In general, laser technology is ideally suited for automobile production. For the laser beam is an instrument that knows no where and tear, with which one can harden, cut and weld batches of parts of any size, which is very important in mass production. But one must not go to the extreme either. Certain technological services of enterprises have submitted to the Scientific Research Institute of Technology of the Automotive Industry (NIITAvtoprom) immense lists of parts for laser hardening without thinking about how justified it is to use in one case or another, or how much the laser installation will cost. When the figures run up into the several tens of thousands of rubles a decision was made: "One must think." After that realistic orders were generated. Thus we gradually optimized the list of parts that require laser processing.

Take, for instance, heads of cylinder blocks. Plants of the branch manufacture them as spare parts in approximately the same quantity as the basic amount because the length of time when a part can be used reliably is inadequate. Designers and technologists of ZIL have tried so many methods to increase the durability of cylinder heads manufactured out of aluminum alloys: they have sprayed them but the powder for spraying has turned out to be more expensive than the head, and the process itself is not very productive. They have tried surfacing them but then the head was deformed and it was necessary to increase the tolerances for the next processing and, consequently, the weight of the blank piece.

In the zones where the head burns through rapidly, they put in iron inserts, but this also required the introduction of very complicated and labor-intensive technology. At the ZIL as early as 1984 the output of heads for spare parts exceeded their output for new motor vehicles by a factor of 1.5. The solution to the problem was found in laser technology. They managed to obtain the thermal hardening they had been looking for. Moreover, the laser thermal processing became a finish operation, since the purity of the surface is retained, as distinct from the traditional methods of thermal processing, after which it was necessary to do finishing operations. In order to use this technology it was necessary to have lasers with continuous operation and sufficiently high reliability and stability under conditions of mass production (at the ZIL 900 heads are processed on one shift). Such a laser of the Kometa model with a capacity of 1 kilowatt was created by the authors' collective of the Istochnik Production Association and manufactured through the joint efforts of this production association, ZIL and NIITAvtoprom.

It is still too early to speak about final results. So far the heads have "run" somewhat more than 200,000 kilometers in various automotive enterprises (this is already 50,000 kilometers more than the previous ones). And the running time is continuing.

Next in line is the assimilation of technologies for laser cutting and welding. From our point of view, in the next 2-3 years cutting will be one of the most promising laser technologies. With the mechanical method of cutting one obtains large jagged pieces which then must be removed. The laser beam produces an exceptionally clean and precise cut. Welding is something for the more distant future since we do not yet have laser installations which would be suitable for welding work in mass production. The existing ones are suitable for processing 50 items, give or take a few, but, for example, they are not suitable for 500,000 since this requires especially high characteristics of stability and reliability. Because of the lack of series-produced reliable lasers and instruments for monitoring and controlling the installations, the rates of assimilation of laser technology are lower than they should and could be. In 1984-1985 the Ministry of the Automotive Industry received almost no laser installations. The "dead season" forced us to think about our own production of laser equipment. To be sure, we also tried to receive help from the Ministry of the Electronics Industry. It is satisfying part of our needs, but this is not enough.

Using the developments of the Ministry of the Electronics Industry we manufactured several lasers and then halted production. They still need serious and lengthy preparation. To be sure, we have not ruled out the idea that we will have to make our own pulse lasers since the Ministry of the Electronic Industry has refused to delivery them and the Ministry of the Electrical Equipment Industry is only producing lasers with continuous action.

Because there are no specialized productions, in terms of certain parameters our lasers are behind the world standard by 5-6 years. The efficiency factor of the laser is low and the structure of radiation of the technical laser is not satisfactory, as a result of which the application of laser welding in mass production is being held up. The metal-intensiveness of the installations and the expenditure of gases and water for cooling are great and there are no means of automation or microprocessors.

Thus the organization of specialized production and the improvement of the quality and reliability of laser installations--these are the primary requirements the consumer places on developers and manufacturers of laser equipment, the State Committee for Science and Technology and the USSR Gosplan which are responsible for the dissemination of new technologies.

The next problem is the economic mechanism, which stimulates the operation of laser and other new technologies. It has not been sufficiently developed yet. the effects from laser technologies will be greatest in organizations that operate motor vehicles as a result of the increased service life and reliability of the engines. And the expenditures will be borne by the automotive industry.

The introduction of laser technologies requires a solution to social problems. First, the training of personnel in VUZes of the country is not yet widespread enough. Actually, only the MVTU imeni N. E. Bauman and the Minsk and Kiev polytechnical institutes are the only ones that engage in this. In our institute for increasing qualifications in the department for new technologies we have had to organize retraining of plant specialists in laser technology. All large automotive plants have created groups and laboratories of laser technology. It will also be necessary to overcome the psychological barrier which always arises when something principally new appears. It is necessary to improve safety techniques and expand benefits for people working with laser equipment. A certain amount has already been done in this regard. The problem of extending vacations for people who work with laser equipment is being solved.

Under the 12th Five-Year Plan in the automotive industry it is intended to increase the volume of laser technology severalfold as compared to the 11th Five-Year Plan. But this will be possible only in the entire complex if problems mentioned above are solved.

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## REGIONAL CENTERS FOR LASER EQUIPMENT SUGGESTED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 33-36

[Article by A. G. Ponomarenko, doctor of physicomathematical sciences, division chief of the Institute for Theoretical and Applied Mechanics of the Siberian Branch of the USSR Academy of Sciences (Novosibirsk): "Regional Centers Are Needed"]

[Text] There are two tendencies in the organizational development of structures that handle problems of laser technologies: the first is centralization and the second is an attempt to solve problems locally, on the basis of the needs and capabilities that exist in the region. There could be some doubt about the correctness of such an attempt. The 27th CPSU Congress emphasized once again the need for improvement of territorial administration of the economy.

The Siberian Branch of the USSR Academy of Sciences has every justification and all the conditions for the creation of a regional center for the development of laser equipment and technology. In addition to our institute, research and development on lasers is being conducted by the Institute of Thermal Physics, the Institute of Automation and Electrometry, and others. There is the question of creating an Institute of Laser Physics on the basis of all the divisions that engage in this scientific problem. In Novosibirsk and other cities of Siberia there are technical VUZes which can train specialists in the new profile, and the Novosibirsk Electrotechnical Institute has already created a department of laser technology.

On a recommendation from the All-Union Scientific Research Institute of Electrometric Equipment, we have approached the Sibelektroterm Production Association with a suggestion to assimilate the production of laser installations. They agreed. The first industrial models of technical lasers have already been assimilated.

And, finally, Siberia has numerous consumers interested in laser technology. In order to clarify how wide the range of potential clients is, we conducted a number of conferences, seminars, and meetings with managers of organizations and territorial agencies and established direct contacts with the enterprises.

The laser installations on which our institute is working are basically intended for machine-building technologies (thermal processing, cutting and welding). The Novosibirsk Aviation Plant imeni V. P. Chkalov, on the basis of contractual relations with the institute, is using our plan to create its own installation for cutting metal since it has not yet found any manufacturers and must do everything itself. The Irkutsk Aircraft Repair Plant of the USSR Ministry of Civil Aviation made a request for a similar installation.

At one time, on the initiative of the Altay Party Kraykom, a conference was held in Barnaul on new technologies in machine building, after which we were approached with requests for cooperation by the Altay Motor Plant, the Sibenergomash Production Association, the Altay Scientific Research Institute of Machine-Building Technology and the Altay Polytechnical Institute.

Many scientific research institutes both in our region and in other regions of the country come to us with requests to develop laser systems for scientific research. In particular, we have managed to satisfy the orders of the Belorussian SSR Academy of Sciences and certain other institutes and organizations. By providing equipment for scientific experiments, we simultaneously create a scientific stockpile for technological industrial lasers.

What tasks should be taken on by the regional center?

1. Embodying in production the scientific stockpile that has already been created. To do this there must be planning and design subdivisions that carry out the engineering completion of the development.
2. Turning completed developments over for introduction and at the same time providing scientific research and experiments for the creation of new, more modern laser systems. As a result of this, the regional center will not duplicate the work of branch scientific research and planning-design organizations.
3. Consulting both with manufacturers and with consumers and training personnel. It seems to us that their on-the-job training of engineer-designers and engineer-technologists should be at the center. It is better to conduct the production practice of students also not at the enterprises, but at the regional center, since in production they are not yet able to learn very much new in the area of laser technologies.

When the regional center is organized in Novosibirsk there will be no need to create everything all over again. The work can be carried out with those resources which already exist. Usually when developing a new structure one tries to obtain new staffs, large capital investments and material resources for it. This destructive approach with which the time for producing a return is delayed was condemned at the 27th Party Congress. A good deal can be done with internal production and personnel resources. Of course, this is difficult, but then the new work will be quickly manifested and produce a result, and then it will be possible to decide how to develop it further.

With this approach to the problem it is very important that the plan for the introduction of new developments at the level of the institutes have certain priorities. It is clear that the creation of new technical equipment and technology involves special tasks. In addition to research, the scientist is forced to devote a certain amount of time to engineering work. It is also necessary to have favorable conditions for material and technical supply in the institute itself, qualified engineering personnel, and solutions to social problems. A very competent specialist left our division in the Kuybyshev Branch of the Physics Institute of the USSR Academy of Sciences (attempts are also being made there to create a regional laser center) simply because he was offered an apartment immediately (here he had been waiting for 10 years).

Of course no regional center can operate if it does not have nearby an enterprise which will assimilate its development. I do not have a very good idea of how Sibelektroterm will fulfill its assignment for series output of laser installations. And yet together we will have to assimilate two more new types of technological lasers with large capacities. We need an immediate decision concerning specialized laser production in this association.

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## CHANGE IN WAGE STRUCTURE URGED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 37-52

[Article by V. I. Shcherbakov, chief of the wage division of the USSR State Committee for Labor and Social Problems (Moscow): "A Radical Restructuring of Wages"]

### [Text] Initial Position

Organization of wages occupies an important place in the system of measures for improving the economic mechanism.

Not everything has been going well with wages up to this point. The first shortcoming in their organization is the weak link between the amounts of earnings and the final results of work. Thus during 1970-1985 differences in wages for individual categories of workers in various branches had a tendency toward a reduction, although the results of the activity of the branches differed essentially. For a long time we have not been able to achieve significant progress in the dynamics of the ratio between the rates of increase in labor productivity and the average wages, although production is constantly being augmented with new, highly effective technical equipment. In a number of branches the rates of the latter indicator exceed the former.

The ratio between the wages of workers and specialists has deteriorated, especially between mass foremen and technologists, highly skilled and less skilled workers, piece-rate workers and time-rate workers. The introduction of new technical equipment frequently causes a reduction of the wages of the workers. The structure of the wage system has become extremely ineffective and it is not optimal, and it is less of a stimulating force in the assimilation of complex, highly skilled and highly productive labor. A number of elements have been transformed into a mechanical increment to wages. The negative social consequences were soon to be felt: a decline in the prestige of engineering labor, a reduction of interest in the assimilation of complex and related work and increasing qualifications, and so forth.

Serious shortcomings appeared in the formation of wage funds. For a long time the basic funds for the payment for labor (the wage fund) were established for the ministries, associations, enterprises and organizations in absolute

amounts, based mainly on the number of workers, their average earnings and the planned increase in the production program. This approach did not stimulate a reduction of the number of personnel or a mobilization of reserves for increasing labor productivity. The changeover to normative methods improved things somewhat, but its advantages were not fully utilized.

The changeover to new wage rates and salaries in production branches in 1972-1975 did not produce a long-term increase in labor productivity either, mainly because the majority of the funds necessary for this were allotted from the state budget.

The material incentive fund is not sufficiently linked to the final results of work either. Changes have been made frequently in the indicator and methods of its formation, but we did not manage to reach a point where the material incentive fund has a serious effect on the dynamics of the growth of labor productivity and product quality. The main reason is that before the introduction of the new conditions for management the shortages in the material incentive fund at the enterprise were practically always covered through intrabranch redistribution, and a large part of the unutilized residual from the results of the year was either drawn into the state budget or was turned into a planned source of formation of the material incentive fund for the next year. In any case, it was "lost" to the enterprise.

Certain fundamentals of the wage rate system have become outdated. The regulation of wages and the increase in wage rates and salaries during the postwar years, for a number of reasons, including objective ones, have affected primarily workers who are less well off. As a result, there was a reduction of the differences in the payment for skilled and simple labor. For example, in light and the food industry the wage rate for a worker of the highest category was only 50-60 percent greater than that of a worker of the first category. The level of the wage rate for workers with average qualifications is unsatisfactory. The average difficulty of labor and the proportion of complicated labor are continuously increasing, and this ratio in wage rates is beginning to seriously impede scientific and technical progress. In recent years the situation has deteriorated in the sphere of preparation of production and there has been a weakening of such extremely important areas as repair and adjustment of equipment and experimental, instrument and machine tool production.

Especially complicated problems appeared in the payment for the labor of specialists. The levels of payment for engineering and technical personnel and ordinary workers came unjustifiably close together. In the majority of branches and in the national economy as a whole, in terms of the rates of growth of wages specialists have lagged significantly behind ordinary workers, and in a number of branches of machine building and in the construction materials and extraction industry the average wages of workers are higher than those of engineering and technical personnel, not only in terms of rates of increase, but also in terms of the absolute amount.

The level of wage rates and salaries that are applied no longer corresponded to the material and cultural level of the workers or the productivity and quality of their labor. The proportion of payment according to wage rates and

salaries in the average earnings during 1975-1985 decreased and in a number of cases it amounts to only 50-55 percent. The low level of the wage rate seriously reduces the incentives of the workers to increase their qualifications and master more complicated kinds of labor, it makes it impossible to qualitatively improve norm-setting for labor and the dynamics of its productivity, and it weakens the entire system of material incentives for labor for other elements in the system of payment (bonuses, additional payments, increments and so forth) lose their stimulating role and act as means of compensation for the low wage rate, and they are transformed into a mechanical addition to the wage rate which is aimed at maintaining the economically necessary level of wages. A reduction of the proportion of the wage rate and the earnings not only increases the drive for the quantity of products to the detriment of their quality, makes them less systematic by weakening the internal interconnection and mutual augmentation of elements, and reduces the stimulating role of wages, but also weakens the plan basis for interbranch and interoccupational regulation. Wages are frequently used as the main means of attracting personnel. Ministries and departments frequently solve problems of production and retaining personnel not through technical measures and improving the conditions for the labor and life of the workers, but through inflating wages and paying unearned increments, bonuses and additional payments.

The dynamics of the growth rates of wages for engineering and technical personnel and workers have not been justified by objective factors and are explained mainly by shortcomings in the wage mechanism. Workers' earnings depend on the occupation, the skill category, productivity and the quality of labor. In the existing mechanism this connection is not very reliable and is not always rigid, but it is still there. The monetary earnings of the worker depend primarily on changes in these factors. The specialist (designer, technologist, engineer, economist, foreman and so forth) experiences a weaker influence from such factors on his wages. The earnings of a specialist depend primarily on the position he holds and the results of the activity of the section, shop or enterprise as a whole. This kind of payment structure has its own pluses and minuses. The latter has become considerably greater. As a result, staffs of managers and various kinds of senior specialists have increased unjustifiably and a large number of small sectors, bureaus, divisions and other subdivisions have appeared. An unjustifiably large number of people with higher education have become ordinary workers. Especially great contradictions have accumulated in the payment for the labor of managers whose salaries have practically not changed for 20 years or more in a number of cases.

The result of all this is a low increase in the effectiveness of production and rates of scientific and technical progress, and this, in turn, has given rise to a "second wave": the effectiveness of production is lower--a new impediment to the growth of the incentive funds and the corresponding bonus payments for managers and specialists.

One cannot continue to agree that the mechanisms for payment for the labor of piece-rate and time-rate workers is not the same. For the former, the wages are linked to the results of labor more closely than for the latter. The organization of norm-setting for labor, which has received reproaches, can be

felt here. It is thought that approximately 90 percent of the norms that are applied are technically substantiated. Yet even according to official statistics they are fulfilled by up to 135 percent, and sometimes they are overfulfilled by a factor of 2-3. In other words, a considerable number of the norms are actually not substantiated, either technically or organizationally or economically. Because of the episodic nature of revisions of norms for output and service with continuous changes in the organizational and technical base, the increase in the effectiveness of labor, which depends on all workers of the enterprise, including designers, technologists, economists and norm setters, is requested mainly in the wages of piece-rate workers.

The payment for the labor of workers is actually not very closely linked to the results of the activity of the collective and bonuses are directed mainly toward stimulating the fulfillment and overfulfillment of the established norms and not the plans of the sections and shops. As a result, the norms are overfulfilled, but many shops and enterprises do not carry out the established plans.

The principles for the construction of certain other elements of the payment for the labor of both workers and specialists have become outdated. For example, in order to compensate for unfavorable working conditions increased wage rates are applied for workers (for difficulty or harmful conditions). With this approach the wages have little to do with the real conditions for labor in the specific work place. It becomes too averaged and depersonalized and depends mainly on the occupation of the worker and not on the actual concentration of difficult and harmful factors. As a result, it becomes difficult to attract workers to workplaces that are actually unfavorable. Increased wages automatically remain when the production is developed on a new technological base or when the working conditions improve considerably. This is especially typical of such occupations as painters, welders, smelters, stamping machine operators, casting machine operators, and so forth. The principles of fairness are not observed either: some receive unjustifiably high wages while others receive lower ones.

Many problems have accumulated in the accounting for the intensiveness of labor. The mechanism for incentives for work according to technically substantiated, interbranch and other progressive norms and normatives is not effective enough. Wages depend little on the degree of actual loading of the worker during his work time. For example, for a drill operator, a stamping machine operator or a conveyor worker the amount of active labor in the norm is 70-90 percent, but for a plane operator it frequently does not exceed 30-50 percent. Yet their wage rates are the same. Of course, additional work, for example, running more than one machine tool, should be accompanied by additional pay. But inadequate loading should also be regulated centrally through the rate part of the wages. But the existing mechanism does not provide such a solution.

The limits of the independence of the enterprises in the area of payment for labor are clearly too narrow. Numerous instructions that have little to do with each other, are frequently contradictory and have not been revised for a long time have "swaddled" the enterprises so tightly and strongly that

sometimes they simply cannot breathe. Some of the instructions directly impede the development of brigade and contract principles of work, the combining of professions and functions, the expansion of zones and norms for service, and they stimulate inflation of the numbers of management personnel. On the basis of these it is difficult to take note of the merits of a good worker and strictly punish a poor one.

From what has been said it is quite understandable that we need a radical restructuring of the system of payment for labor. On the basis of program documents, the CPSU Central Committee, the USSR Council of Ministers and the AUCCTU have adopted a decree directed toward a radical improvement in payment for the labor of workers of production branches of the national economy. At its base are new wage rates and salaries.

#### Reform of the System of Payment for Labor

Today the revision of the wage rate conditions is proceeding differently from in the 1960's and 1970's. At the 27th CPSU Congress it was emphasized that "the increase in wage rates and salaries for workers and employees in production branches earmarked for the 12th Five-Year Plan will take place first as a result of and within the limits of funds earned by the enterprises themselves."

With the introduction of the new wage conditions it is intended to solve a number of most important problems:

to increase the material interest of labor collectives and individual workers in the fulfillment and overfulfillment of assignments of the five-year plan and the achievement of high final results; to increase the influence of the system of payment on the implementation of priority tasks--acceleration of scientific and technical progress, a considerable improvement in the quality of products and labor, a radical improvement in the dynamics of the rates of increase in labor productivity, and economy on all kinds of resources.

To distinguish by payment for labor people who are employed in the development, introduction and servicing of new, highly productive technical equipment and to direct the entire system of payment for labor toward the acceleration of scientific and technical progress;

to provide for substantiated ratios in the payment for labor among workers and engineering and technical personnel and for various professions and skill groups;

to radically improve the organization of wages and increase the stimulating role of all constituent parts of them--the rate, additional payments, increments and bonuses;

to considerably expand the rights of enterprises in implementing the state policy in the area of payment for labor.

For the first time in many years one document envisions conducting a large restructuring of practically all of the monetary payment for labor. Moreover,

wages are considered as a system in the interconnection and interaction of all the basic elements. Actually, we are speaking about a large reform of wages.

Conducting the reform is closely coordinated with the improvement of the economic mechanism and the introduction into practice of the principles of cost accounting, self-financing and self-repayment of enterprises. In particular, for the first time the changeover to the new wage rates and salaries, which have increased quite significantly (for workers, by an average of 20-25 percent, and for specialists and employees--by 30-35 percent) is being completed without subsidies from the state budget. The enterprises must earn the necessary funds independently, and these principles are in effect not for individual enterprises and organizations (for example, AvtoVAZ or the Sumy NPO imeni M. V. Frunze), but for all production branches of the national economy.

By 1987 it is intended to complete the changeover of all production branches to normative methods of forming funds for payment for labor. The normatives for the formation of the wage fund and material incentive fund are long-term and stable. They must be differentiated by the ministries depending on the actual conditions for the operation of enterprises and the reserves they actually have. There is a guarantee that the funds earned by the enterprises will remain at their disposal for an extended period and will not be removed and redistributed in favor of those that are not operating effectively enough and can be used entirely for increasing wage rates and salaries. The situation is similar within the enterprise: each category of workers earns some money for new wage rates and salaries independently. For this the overall wage fund is divided into individual funds: of workers, designers and technologists, workers of the quality control service, and all other specialists.

The wage fund is the basic source for changing over to the new system of rates and salaries. But if necessary, by a decision of the labor collective, during the year of changeover some of the material incentive funds can be used for these purposes. Then in subsequent years, when forming the funds, the corresponding changes are made in their base values. It should be noted that the normatives for increasing the wage fund produce a greater increase in money for wages than for the material incentive funds. Therefore, drawing money out of the material incentive fund is economically disadvantageous. Moreover, it means that they are actually speaking about revising the structure of wages and the real increase in earnings.

The decree that has been adopted envisions improving interbranch ratios in wages and creating advantages for branches that determine the acceleration of the rates of scientific and technical progress and economic development. Wage rates and salaries are increased by a greater amount than average for workers in the energy, fuel-ore, petroleum and gas extraction industry, construction, air and rail transportation, light and the food industry, and the differences in the payment for labor will be increased for workers in machine-building branches and local industry. At the same time there will be stronger unity in the payment for the labor of people employed in more general occupations, who perform work of the same difficulty in various branches of the national economy. As a rule, a unified system for payment will be introduced for

repair workers, adjusters, workers of startup and adjustment organizations, engineers, economists, legal experts and a number of other specialists and employees.

In practically all branches it is intended to increase rates more for highly skilled workers, thus increasing the ratio between the extreme (1 and 6) categories as a rule, to 1:1.8 (at the present time in light and the food industry it is 1:1.57, and in machine building--1:1.71).

In machine building a special group of wage rates is singled out (higher than for ordinary workers by 20 percent) for those who create new technical equipment and are first to assimilate it (instrument operators, universal machine tool operators, adjusters and repairmen of especially complicated machines, automated lines and flexible production systems). For them an eight-category network is introduced instead of the existing six-category one. On the whole their rates will increase by 45-50 percent.

In energy engineering higher wage rates (8-10 percent higher than at thermal electric power stations) were assigned for workers at atomic electric power stations. For workers with the highest qualifications employed in the service of especially complicated and powerful turbines wage rates were established beyond the categories--220 and 240 rubles. In metallurgy special higher rates were assigned for workers with high qualifications who run powerful, complicated and unique equipment in basic production and also highly productive technical equipment in the mines.

In light industry the greatest increases in rates were received by highly skilled workers of the sewing and knitting industry, mainly in the 4th-6th categories. In the food industry they single out workers from such leading subbranches as bread baking, meat processing and sugar.

In transportation special higher rates will be introduced for the drivers working with long, heavy and high-speed trains, drivers of highly productive and new models of trucks (KamAZ, BelAZ dump trucks and so forth) and also those working with trailers. There will be an essential increase (up to 40 percent) in the wage rates for people employed in loading and unloading work.

Radical changes will be made in the structure of the wage rates for workers in agricultural production and builders.

Other constituent parts of wages are being unified according to amounts and purpose. Thus all branches are to extensively use additional payments for occupational mastery and increments for class ratings. Now additional payments and increments are linked not to the length of service, but to the increase in the actual qualifications of the worker and depend only on the results of his labor--his ability to perform work more complicated than is envisioned by the class category, quality of labor, mastery of associated functions and operations, and so forth. For highly skilled workers who perform especially complicated and responsible work in all branches personal salaries can be introduced instead of the wage rates.

For the first time a mechanism is created not only for appreciable stimulation of high-quality labor, but also for material responsibility for the manufacture of poor-quality products. With the deterioration of quality and regular violations of technological discipline not only are additional payments and increments for professional mastery and class ratings abolished, but the class category can also be lowered.

Payment is being structured in a new way, depending on the actual working conditions. In the majority of branches the rights of associations and enterprises in this area are being considerably expanded. They can differentiate payment independently. In order to compensate for unfavorable conditions, instead of increased wage rates, an additional payment of up to 24 percent of the wage rate is being introduced. Its amount is determined depending on the characteristics of the specific work place on the basis of the certification of work places and the provisions established by the USSR State Committee for Labor and Social Problems and the AUCCTU concerning evaluation of working conditions, the list of heavy and especially harmful jobs, and also branch lists of these jobs. Thus for the first time the majority of branches are changing over completely to a single wage rate for all workers and the working conditions are linked not to the worker's occupation, but to the specific work place and the actual time of work in it. The list of work places and amounts of additional payments should be established annually by the enterprise in a collective agreement and revised according to the results of the certification of work places.

It is permitted to apply an additional payment of up to 12 percent of the wage rate for increasing intensiveness of labor, that is, employment in active work on conveyors, flow lines and automated lines in machine building and light industry. The amounts of these additional payments are established by the manager of the enterprise with the agreement of the trade union committee also according to the results of the certification of the work places.

The mechanism for establishing additional payments for working conditions is fairly simple: according to a number of parameters related mainly to the medical and biological conditions for labor. As a base, that is, the maximum possible amount, they use a list of jobs and occupations with difficult and harmful or especially difficult and especially harmful working conditions. The mechanism for establishing the additional payments for increased intensiveness of labor is more complicated. In machine building, to do this one evaluates the employment in active work in the norm of labor expenditures. When norm setting is arranged correctly it is relatively simple to conduct such an analysis. For each kind of work one establishes the branch normative indicator, and if the active load exceeds the normative value, the manager of the enterprise has the right to establish an additional payment to the wage rate, depending on the degree to which the load exceeds the normative. Additional payments for the conditions and intensiveness of labor are calculated for the time of the actual work under specific conditions and cannot exceed 24 percent of the wage rate. They are included in the wage rates in all calculations related to payment for labor.

Significant changes will be made in the payment for engineering and technical personnel and employees. On the whole, salaries for engineering and technical

personnel will increase by approximately 10-20 percentage points more than the wage rates of workers will. Advantages will be given to the leading categories that determine scientific and technical progress and the effectiveness of production--line managers (foremen, chiefs of sections and shops), and designers and technologists of products that determine the profile. This will also affect mine surveyors, geologists, artist-designers and workers in the quality control service. Their salaries will increase by 40-45 percent.

Categories will be established for engineers of all specialties, economists, technicians and other specialists analogous to the categories of designers and technologists and the assignment of class ratings to foremen. Instead of two positions--engineers and senior engineers--there will be qualifications categories: specialist without category, Categories I and II, and leading specialist. For designers, technologists and engineers in organization and norm-setting of labor a third category will also be introduced. At the same time better possibilities are created for increasing occupational mastery within the limits of the qualifications category that has been assigned. To accomplish this there will be a considerable increase in the range of maximum and minimum salaries. Now the "spread" of the salary, as a rule, is 40-50 rubles. While before the introduction of the new conditions for payment an engineer at an enterprise that manufactures especially complicated products could obtain from 115 to 150 rubles, now his salary without a category can be from 140 to 190 rubles. When the qualifications category is assigned, for example, a designer and a technologist, solely as a result of increasing their occupational mastery and qualifications can achieve an increase in salary from 140 to 260 rubles; an engineer in another specialty and an economist--from 140 to 240 rubles. Moreover, increments can be applied to the salaries for high achievements in labor or the performance of the most important and responsible work in an amount of up to 50 percent of the salary. Consequently, for a designer or technologist who is working well, the wage rate part of the earnings can amount to 390 rubles.

According to the existing system a foreman can have a salary of 140-150 rubles and according to the new one--160-220 rubles; when he reaches first class his salary increases by 20 percent; and when he achieves high results in labor he can be given an increment of up to 50 percent of his salary.

Services involved in activating the "human factor" in production are being strengthened significantly. In all branches the salary systems include the occupations of engineers for organization and norm-setting for labor, sociologists, psychologists and physiologists. Services are being created for sociology and psychology of labor, social development, subsidiary farming, and insurance of quality of products and labor in places where they did not formerly exist (construction, transportation, extraction branches and so forth). Salaries have been increased for specialists in such traditionally neglected services as personnel, legal, and bookkeeping. Technicians' salaries have been increased significantly.

There is to be a further increase in the role of certification when evaluating the effectiveness of the labor of all categories of workers. Managers of enterprises and associations are being given the right to make decisions on

the basis of this not only concerning promotions, assigning categories (classes), increasing salaries and establishing increments to them, but also reducing salaries of individual workers to the minimum established amounts for a given position, reducing or abolishing increments, and, if necessary, firing them from their job. The introduction of categories for engineering and technical personnel and the considerable expansion of the "spread" of official salaries are accompanied by an elimination of planning of the ratio between the number of workers in various qualifications categories, senior and rank-and-file specialists and average salaries according to the system.

The distribution charts for divisions and services are to be formed in a principally new way. There will be practically no permanent distribution. It is envisioned that each subdivision should have an established wage fund, rules for changing it (for example, normatives for increase and reduction) and an overall maximum number of specialists. Within these parameters, on the basis of certification, each specialist can be advanced in the categories and have his salary increased.

Special attention has been devoted to improving wages for managers--chiefs of shops and sections, directors and their deputies. A timely measure: thus the salary of the director of a large textile combine of Group I is 250-275 rubles, a large sewing factory of Group I or a machine-building plant of Group III--220-260 rubles, and the average wages of workers in industry are more than 210 rubles.

In the new system the salaries of chiefs of shops and divisions have been formulated in such a way as to exceed the wage rates of workers of the highest category by 60-90 percent. The salaries of directors of enterprises according to the new system increased by an average of 100 rubles and in machine building are 400 rubles (at the present time 300-330), ferrous metallurgy--470 (350-400), light industry--350 rubles (in the sewing industry--220-260 and in the textile industry--250-275). The salary of a manager of a construction and installation trust reaches 450 rubles and that of a chief on the railroad--500 rubles.

At the same time, the system introduces salaries for general directors of production associations and combines: in the food industry--350 rubles, in light industry--380, machine building--430, and ferrous metallurgy (for the director of a large combine)--500 rubles. When the associations and enterprises and their structural subdivisions and shops exceed the indicators of the categories envisioned for the first group for wages no less than two-fold, the salaries of the management workers will be increased by 15 percent. Thus the salary of the general directors of such large associations as, for example, Uralmash and AvtoZIL will be 480-520 rubles.

All of these changes are not to take place automatically and therefore greater demands will be placed on the categorizing of enterprises in groups according to wages. It is intended to increase them by 20-30 percent. But also when a group is reduced according to wages even by two levels there will be an increase in the salaries of managers as compared to today's salaries, although, naturally, they will increase by smaller amounts. The number of workers has been derived from a number of indicators of the categories and the

output of products at the level of world standards is taken into account as one of the most important indicators when including enterprises in groups for the payment for the labor of management workers. As a result, for example, in machine building the managers of many enterprises that are included in Groups III and IV according to volume, when the proportion of products of the highest quality category increases by 25 percent as compared to the average for the subbranch, can claim a salary for one group higher. And, conversely, when this proportion drops below 25 percent, the salary group can be reduced.

The considerable expansion of the rights of enterprises in the area of providing incentives for highly productive labor and selecting forms and systems of paying for it is characterized, in addition to what has been said, by the fact that the contract and piece-rate forms of organization and payment for labor can be introduced for shops, sections and other structural subdivisions and all categories of workers, including specialists, by the enterprises themselves without additional agreements with the higher agencies. The enterprises have also been given the right to determine the list of jobs and occupations which workers can combine.

Additional payments for combining occupations and jobs, expanding service zones or increasing the volume of work that is performed are established by the enterprises at their own discretion. They can use for these purposes all the savings on the wage fund that are formed as a result of releasing workers, and the amount of additional payments for one worker is not limited. Completely new opportunities have been offered to the enterprises in the area of organizing bonuses. Beginning on 1 January 1987 practically all the limitations imposed by the numerous acts, provisions, and instructions on their independence in spending funds for bonuses and determining the amount of individual payments will be removed. The enterprises have a right to develop bonus systems independently, to establish indicators, conditions and amounts of bonuses, to combine all funds for bonuses into a unified fund, and to determine independently the areas for its expenditure. The rights of all of their structural subdivisions and labor collectives are also being expanded. It is intended to change over from individual bonuses to collective ones for all categories of workers. The maximum amounts of the bonuses are established for the collective as a whole and within these amounts there are no limits on the amounts of bonuses that can be awarded to individual workers.

#### What To Do

Associations and enterprises in conjunction with the trade union committees must develop and implement a large complex of technical organizational and economic measures that provide for reducing the number of workers and economizing on existing wage funds. This can be achieved primarily as a result of raising the technical level of production, reducing the proportion of manual labor and improving conditions for labor, conducting certification and streamlining workplaces, providing for balance between these and labor resources, and increasing the effectiveness of the utilization of fixed capital and capital investments. A radical change must take place in the dissemination of collective forms of organization and stimulation of labor and in the introduction of cost accounting and contract principles of work for brigades, sections and shops.

The increase in wage rates and salaries should be accompanied by radical changes in norm-setting for labor, expansion of the sphere of normed labor and improvement of its quality. It is necessary to revise existing norms and normatives for labor expenditures and replace them with more progressive and technically substantiated ones. The existing norms and normatives, including those that are applied for evaluating the labor of engineering and technical personnel, must be increased, according to calculations, by 20-25 percent.

It is also necessary to achieve significant improvement in the system of bonuses, above all to significantly simplify it, make it comprehensible to every worker, and essentially expand the rights of labor collectives in determining the specific amounts of indicators and conditions for bonuses.

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## PROBLEMS WITH INTRODUCING NEW TECHNOLOGY RELATED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 53-70

[Article by Tatyana Boldyreva: "The Plant Where the Watches Stop"; first two paragraphs, EKO introduction]

[Text] In EKO No 1 for last year the director of the Sayansk Aluminum Plant, V. V. Strigo, discussed the difficulties the enterprise was experiencing. This plant, one of the new construction projects of all-union significance in Krasnoyarsk Kray, is applying principally new technology for the production of aluminum. But the prolonged planning and construction and the basic sets of technological equipment for smelting aluminum which had not been brought up "to condition" led to a situation where the plant, which began to be constructed in 1976 and produced its first metal on 22 April 1985, from the first days of its operation began to have a hard time.

The new technology is being introduced with a great deal of difficulty and the plant has a large number of unsolved problems and losses--this is what our magazine's correspondent found when she went back to visit the Sayansk Aluminum Plant.

If a new tenant who had moved into an apartment immediately demanded that his electric wiring and water pipes be replaced, that the layout of the apartment be changed, that the balcony and the exit from the apartment be put in different places, one could imagine what he would hear from the planners and the builders!... The director of the Sayansk Aluminum Plant, V. V. Strigo, is quite like such a new tenant, who so far has "moved in" to only one shop that produces products (and this is less than 10 percent).

### Metal Disappears and Something Else

They had just installed the first electrolyzers--sets of equipment in which aluminum is smelted--and the director was thinking about reconstruction a plant that had not begun to operate. His behavior seemed strange, the more so since the sets of equipment, which had been designed by the All-Union Scientific Research and Planning Institute of the Aluminum, Magnesium and Electrode Industry (VAMI), were advertised as the best world models, which were powerful and highly automated. This is the way they were described in

official documents. They were used at the Tajik Aluminum Plant (TadAZ), but they did not show their best side there. They operated unstably and the planned indicators were not reached. They did not manage to put the automated equipment into operation there either--the ASU TP. And without it labor expenditures exceeded the planned levels by a factor of almost 3. At SaAZ they installed the same electrolyzers as at TadAZ, but they were somewhat modernized. But the defects of the equipment were not manifested at first, and V. V. Strigo's uneasiness seemed unjustified and premature.

In the spring of 1985 the VAMI equipment produced its first metal at Sayansk. In February 1986 the electrolysis shop reached its planned capacity and the entire country learned of this event on the radio. But even a nonspecialist could see that many of the sets of equipment were already in repair, although their first repair was not to be done until after 3 years. And the equipment that was in operation did not produce what it was supposed to....

...After a button is pressed the semicircular lids of the equipment opened and a worker breaks through the crust and stirs the liquid in the vat with a slotted ladle.

"We do a lot of other things by hand as well," says the brigade leader of the electrolysis shop, S. N. Deynitsyn. "We remove the carbon and clean the anodes. Automation? There is a system for automated feeding of the aluminum on 10 of the sets of equipment. But it works poorly. The aluminum is poured by a crane-manipulator, but it does not manage to complete all the operations....

And so "unplanned" carts with drivers moves through the shop in order to manage to load the aluminum into the vats. Moreover, one cannot see anything because of the white dust in the air.

And the people working here are class-rated specialists from many old aluminum plants who have heard that everything is different at Sayanogorsk: neither dust nor smoke, and everything is automated....

The deputy chief of the electrolysis shop, A. G. Buks, was not very happy:

"Of the several dozen electrolyzers 10 have had capital repair, another five are being repaired, and eight are in local repair. And the rest will soon end up in the same place: the vats are being destroyed and their bottoms are being deformed. The metal "runs" from the vat into the lower level of the shop and stands there on the floor. It is not easy. The hardened solution in the vat has to be broken up with a jackhammer. The quality of the metal deteriorates. We produce poor-quality metal with an admixture of iron. The imported system for gas purification removes almost all of the gases, but...only when the electrolyzer is closed and is working automatically. We open it many times a shift, and the gas goes not to the gas purifier, but up to the ceiling...."

And so the modernized sets of equipment of SaAZ are not much different from those that were used at the Tajik Plant more than 10 years ago.

"We are repeating the Tajik experience completely, in terms of the number of personnel also," said the director of SaAZ, V. V. Strigo.

#### When the New Is No Better Than the Old...

The technology for the production of aluminum seems simple. And the sets of equipment for smelting aluminum do not impress one with their sizes. The vat at the level of the floor is 16 meters long and is covered by a housing. Carbons weighing about a ton each are dropped into the vat--these are anodes through which the electric current passes. The vat is small, about 0.5 meters deep and lined with carbon blocks. If one opens the housing it is like a bonfire that is dying out under a layer of ash.

But the external simplicity of the technology is deceptive: the temperature is high, the environment aggressive, and therefore the windows in the shop are not glass, but are made of blue and green semitransparent plastic. Ordinary glass becomes dirty. And the many physical and chemical processes taking place in the vat have no theoretically simple explanation.

P. V. Polyakov, doctor of technical sciences (Krasnoyarks Institute of Nonferrous Metals) says:

"We have known about electrolyzers with roasted anodes for more than 40 years. And we were the first to try to use them. But because of the difficulties with the production of burnt anodes, two types of electrolyzers became widespread in the aluminum industry--with self-burning anodes. This technology is used (with the exception of individual sections) by all plants of the country except for the Tajik and Sayansk plants, including the Siberian giants--the Bratsk and Krasnoyarsk aluminum plants. The technology was assimilated and the physical plants grew rapidly. And the production of aluminum is less expensive, since one does not need a special anode production. Our aluminum industry was considered to be the leading one in the world. Licenses were purchased from us and aluminum plants were constructed using our plants in Turkey, Egypt and India. During the 1960's a new technology began to spread abroad--with burnt anodes. It provides many advantages: less expenditure of electric energy per ton of product and ecological purity. But our electrolyzers are as good as foreign ones in terms of many parameters...."

Petr Vasilyevich showed the schematic chart for electrolysis with roasted anodes and spoke about the still-unsolved scientific and practical problems. And the thought occurred that if these had not been solved, why set up another plan according to the same technology, first the Tajik Plant, and then a second, dooming them to a situation that will be filled with technological problems even before the startup of the first basic shop.

VAMI did not recognize the shortcomings in the plan and design of the sets of equipment. They maintained a unified front. I spoke with many workers who participated in the plan for SaAZ and nobody had any doubts about anything. The head engineer of the institute for the planning section, V. P. Nikiforov, pointed out the merits of the new technology and the local conditions of Tajikistan, which make it difficult for these merits to be fully manifested.

"SaAZ is a large step in the development of the subbranch," he said. "There are many new technical solutions there: a new modification of electrolyzers with an automated system for feeding the aluminum, complex crane manipulators with overhead equipment instead of the floor servicing of equipment. Working conditions have been facilitated. The plant has entered on the correct path for realizing all the planning decisions. This eliminates manual labor. But the electrolyzers must not only be planned and constructed, but also operated correctly. The complex is complicated. The qualifications of personnel at the Tajik Plant are low. In the first buildings the personnel were better, and they are operating stably. Incidentally, plants constructed according to our plans abroad are operating very well. Take the Egyptian plant that is an analogue to the Bratsk Plant...." Nikiforov takes out a sheaf of papers with indicators. "And in general our electrolyzers are just as good as foreign ones. At the plant they say that they did not pass the test but still were put into series production. Nothing of the kind! They were tested at the Volgograd Aluminum Plant and they had good indicators in the branch...."

The tables are good: everything is clear. In terms of such important indicators as the output of metal from one square meter of production area and the proportional expenditure of electric energy we are significantly behind the leading foreign firms. As for the effectiveness of the covering of the sets of equipment (ecological cleanliness depends on this), here we are at that level only in the plan; and in reality in the facilities that have been put into operation things are not so good. And labor expenditures (man-hours per ton) even in the plan for SaAZ are higher than in the leading foreign firms and only slightly lower than at BrAZ. In facilities that have been started up at TadAZ they are almost 3 times (!) higher than they should be according to the plan for SaAZ, not to mention foreign plants. V. P. Nikiforov explains this again by the fact that the personnel has not at all mastered the modern equipment and also the fact that the process at TadAZ is not automated and the ASU TP Elektroliz has not been introduced.

In the end it turns out that TadAZ has discredited the new technology and SaAZ is rehabilitating it.

But it is not at all a matter of technology: in and of itself in many respects it surpasses the preceding technology. But the technological equipment, the electrolyzers, were put into series operation before they were fully developed. The first sets of equipment with roasted anodes were less powerful --by 160 kA--and operated stably. Thus without proper testing they put more powerful equipment into operation at TadAZ, 175 kA, and then super powerful equipment--255 kA. Here is where heretofore hidden imperfections of design appeared, which led to the technological process being disturbed, and the vat began to be destroyed. The quality of the metal deteriorated. During 1984-1985 alone the Tajik plant had about 100 million rubles in losses. As the chief of the Soyuzalyuminii VPO, B. G. Zlokazov, admits, when the current is increased beyond 160 kA the calculation methods used by VAMI failed. But the institute had confidence in its equipment and trusted it. For it to lose this confidence and recognize the shortcomings which had long been obvious, it was necessary for them to be criticized at the June (1985) Conference of the CPSU Central Committee on Scientific and Technical Progress, and in press articles.

## How To Recover Losses?

The Sayansk Aluminum Plant was to have been a model plant in the branch. But, unfortunately, that is still a long ways away. The plant, in and of itself, is very expensive as compared to those which have the "old" technology with self-roasting anodes. Entire technological chains purchased abroad rely on domestic electrolysis--the basic operation which is similar to a hole into which metal that is so needed flows.

The chief of the planning and economics administration of the USSR Ministry of Nonferrous Metallurgy, V. M. Kostyuk, links the hopes for a more rapid return from invested funds to a reduced expenditure of raw material and energy per unit of output and higher labor productivity:

"I think that a small profit will appear only with the startup of no less than half of the electrolysis facilities. In order for there to be a return by the end of the five-year plan it is necessary to construct no less than seven electrolysis facilities. If this is not done the prospects of operating without losses will be postponed. TadAZ is also operating at a loss even though it was planned to have profit as early as 1984. But at SaAZ we are not expecting this kind of a picture...."

Now let us take a look at what the director of SaAZ, V. V. Strigo, expects:

"Behind the discussions of innovation of technology the main thing is forgotten: how much this thing costs. In general we rarely discuss this. Predictions concerning savings for our plant are depressing, but it is difficult to be reconciled to this. One cannot spend without keeping track. I think a special group of specialists who know everything that exists in the country and abroad should work on making the plan less expensive. It is not easy to do this at the level of the plant. But I can see how it would be possible to make the production advantageous. We have suggested our idea both to VAMI and to the ministry: to obtain significantly more metal from the same areas and equipment...."

The director's workday begins in the electrolysis facility at the end of which the equipment with the new design is installed. Externally they are similar to the series-produced equipment standing along the corridor. But they are arranged crossways. One of the creators of the design, the plant's deputy director for new technical equipment and technology, former chief of the experimental electrolysis shop of TadAZ, A. M. Ivanov, discusses what distinguishes the new electrolyzer of the Tekhnolog type:

"I began working in the aluminum industry 25 years ago as a an electrolysis worker. I looked at the equipment and thought that I would like to create an electrolyzer that was not worse, but better than those to be found abroad. I got tired of rendering 'first aid' to hopelessly ill equipment. Our Tekhnolog is completely automated, it has a principally different design of the vat, and the magnetic fields are better because of the new leads...."

Tekhnolog requires one-third of the amount of metal and working conditions improve. It is still too early to draw final conclusions. But it is clear that it works better than series-produced equipment. The first tests have already been conducted and produced promising results.

The plant links its hopes for achieving the planning indicators to Tekhnolog. It is these electrolyzers and not the series-produced ones that the director wishes to use in the other shops. An adventure? After all, the shops have already been planned.

"No adventure," says V. V. Strigo. "We have a precise calculation. In all the facilities, beginning with the third, we want to install new electrolyzers. They are now operating at a fourth of current of 175 kA, and we are testing them for 190-200 kA, and then--another modification--for 260 kA and higher. The increased force of the current will also produce better economic indicators."

"But at the Tajik Plant the superpowerful electrolyzers with 255 kA are not working, are they?"

"They will work. The output of products from the same facilities will increase 1.3-1.5-fold as compared to the plan. But with the equipment which is now being offered to us by VAMI and which has been discredited both here and at TadAZ we will never reach the planned capacity. If one is to agree with VAMI the planned losses in 1986 of 23 million rubles will reach 50 million rubles by 1989. Something must be done. With our suggestion the plant will operate at a loss until 1990 out of inertia, and in 1990 the losses will start to decrease sharply, and in 1991 we will produce a profit."

Note that Strigo is not only speaking, but also pointing to numerous tables from which one can see clearly the obvious contradictions inherent in the tables that were seen at VAMI. And according to the calculations of the Supernumerary Plant "Scientific Research" Group headed by the director, the reference calculations are deceptive.

The estimated cost of construction of the plant is not being increased and the facility remains according to the plan. Only the equipment and the system of automation will be changed. There is documentation for the new equipment.

Will this group be able to win in the comparison of estimates and the acceleration of the hooking of equipment and electrical supply circuits? In obtaining electric rectifier equipment from Uralelektryazhmash? After all, as they say, without VAMI the sun will not rise on the aluminum industry.

Yet the attitude of VAMI and the ministry toward technical innovations is not very innovative. When pushing through their ideas, V. V. Strigo and A. N. Ivanov, who are aluminum workers down to the roots of their hair, frequently feel like "aliens," then it is not easy for them to put up with departmental pressure. But how does one deal with Strigo, who declares:

"Although the construction project supports us, I must deal with this problem: making the electrolyzers viable. It is our plant and our right. But one

cannot get around the institute. Only it produces documentation, and the bank gives money according to its documents.... They are always helping us in words, but in deeds, when we suggest something, they say: find another way. Now they are suggesting that we take our electrolyzer and "break it into parts"--some element will be taken from the old one and others will be taken from ours. Just so long as they do not approve the plant design completely, and can call it theirs, which has been improved. But we are taking our equipment to the point of state testing...."

The Soyuzalyuminiy VPO does not refuse their suggestions, but they do not approve them either. V. V. Strigo suggested: "Let us take a look at the comparative results. For instance, let us compare our equipment and the series-produced equipment after 2 months and a half-year." Strigo had long ago bored them with his proposals and initiatives. Again an outdated device--do not respond to them, pay no attention.

#### The Story of the Geography of the USSR Ministry of Nonferrous Metallurgy

In EKO No 1 for 1986 for the article entitled "Heavy Aluminum" the artist sketched a charming picture: the director, down on his knees, is asking God for more rights. And God answers: "Of course, my son, the last word will always remain with VAMI."

The VAMI Institute, like the Lord God Himself, is triune or even includes more bodies in one--it is a scientific research, planning and design institution, and a "monopolist" in the aluminum subbranch. It creates the design of the plant, designs the equipment, conducts research and orders the equipment. Nothing in the subbranch is decided without VAMI. And what do they think about things at the new plant?

"We are not so far behind," says A. N. Smorodinov, the head engineer of the division for the aluminum industry. He is a frequent guest at SaAZ. "And as for the technology everything is at the proper level. Our electrolyzers are as good as foreign ones. Their service life is also just as long. But when it comes to mechanization and automation we are progressing slowly. And because of this labor expenditures are higher...."

At VAMI they will kindly reject any idea that the plant's design of electrolyzers is better. Possibly in the new equipment designed by plant specialists some parts have not been completely worked out and they must be finished. So why not do this through combined efforts? The more since they cannot be ignored altogether?

"While we are working on a new design they are going around with notepads and sketching and writing. They can draw beautifully," the independent plant group would be willing to take their equipment out of the plant and lock it up so that VAMI representatives would not go around with their notepads....

Who is right here? Who will join together the specialists of the two plants and VAMI? Administrations or divisions of the Ministry of Nonferrous Metallurgy?

A division chief of the Soyuzalyuminiy VPO, A. F. Luzan:

"The 'brainchild' in Sayansk will be stronger than the one in Tajikistan, but we will raise no knights there unless we adjust the complex of service installations and automatic equipment. This has not been thoroughly thought out and without it a highly mechanized electrolyzer is simply a vat with anodes. Automated equipment should regulate a multitude of parameters of the process, but it is not working. There is no reliable mechanism for servicing the electrolyzers. Czech automated crane-manipulators have been purchased, but they have not been completely assimilated."

Luzan did not mention the fact that these cranes were made on order and according to blueprints of VAMI, that their lifting capacity is inadequate, and when the temperature drops below minus 35, as it frequently does in Sayanogorsk, it takes four strong men to turn the crane in the necessary direction. Moreover, in terms of precision the crane is almost a robot and the electrolyzer is a metal structure and joined together they look like a micrometer and a carpenter's meter.

But how can A. S. Luzan's division help?

"It would be good to have an experimentation section, we produce metal, but the expenditures...."

"Incidentally, for the experimental shop we need only 10 million. Compare that with the losses of TadAZ...."

It is clear that the "brainchild" is still a foreigner to this division.

The deputy chief of the Soyuzalyuminiy VPO, V. S. Kalchenko, also considers the electrolyzers to be "from another department": all the "aluminum" affairs are concentrated here, and there can be no complaint about dispersion. Kalchenko explains the slow assimilation of the new technology with the roasted anodes by the poor interaction between the machine builders and other ministries.

"The machine-building ministries have been unprepared for the production of anodes and the complex of service equipment. All this was purchased abroad. As early as 1979 a decision was made: to reproduce foreign equipment. A number of ministries were to have engaged in this: the Ministry of Heavy Machine Building, the Ministry of Chemical and Petrochemical Machine Building and the Ministry of Machine Tool and Tool-Building Industry. But so far the problem has not been solved. At TadAZ they have no spare parts for the imported equipment for producing roasted anodes.... We cannot even clearly judge the expenditure indicators for the process of electrolysis: the instruments have a margin of error of 2 percent. And we paid the scientists millions of rubles for independently financed work, but there is no return."

In general, Kalchenko thinks that the difficulties have been exaggerated. Electrolyzers have been created which, in terms of their technical direction, correspond to the best world level. True, the experimental models have not produced what was expected of them. But the search is proceeding in broad

areas and science has been included. At TadAZ and SaAZ they have created experimental sections where they are testing suggestions of the plant workers --new types of electrolyzers. But still....

"I do not believe it," said Kalchenko. "But let them do their testing, and suddenly things will work out."

Obviously, the attitude is the same in the institute and in the ministry. We are constructing... We are introducing... But we will worry about it later if the time for payment or even for calculations actually comes.

Therefore one could make a testing ground out of the Tajik Plant, where powerful electrolyzers have been put into series production without being completely developed or tested. The plant workers correct first one and then another defect, but all this is nothing more than patching up holes. One cannot say that the specialists from VAMI and the VPO have not spent enough time at the new plants. Moreover, permanent divisions of VAMI "sit" at the plants.... But this is "first aid" or "a fire team," which are directed toward local improvement of first one and then another minor point, although from the viewpoint of VAMI this can be also be called restructuring on the move. Is it possible to technically reequip the aluminum industry this way? Hardly, but it is quite possible to spend a whopping 3 billion rubles on two poorly operating plants.

And, of course, the Ministry of Nonferrous Metallurgy simply will not consider the alternative: a large institute, 4,000 people--and an independent group whose prospects could quite possibly be called independent, fabricated, unclear and whatever else one may wish.

The Ministry of Nonferrous Metallurgy certainly does not expect that anything will come of this. And the proximity of VAMI to the Ministry has absolutely no influence.

"It is better for the director not to work on innovations, but supervise the installation," the deputy chief of the VPO, V. S. Kalchenko, takes out a large table on which rows of multicolored circles and triangles mark the peculiarities of the work of all equipment in the shop.

"You can see the difference in the operation of the equipment in the northern and southern parts of the shop? If they were installed properly and started up without violations, they would not leak...."

But one can see that the electrolyzers are still malfunctioning, although to a lesser degree, even in places where the installation was better. But why does VAMI along with VPO not carry out their functions, why do they not supervise such an important operation, on which the future operation of the shop depends, and why do they sign the document for acceptance of the shop where the equipment has not been installed well?

"Here they complain about the VAMI equipment, but at the Tajik Plant the last facility was put into operation in November 1985 and there the same equipment as they have in Sayansk works better because it was installed better and the

personnel have been taught how to service it," continues V. S. Kalchenko. "And in general the capacities at TadAZ have been assimilated by 94-98 percent, and not everyone can boast of this."

But what is assimilation of capacities at a plant that has losses of many millions? How after 12 years can one be glad about the fact that things have finally started to go better? And the main thing--in the history of new technology it is clear that the VPO and the ministry have abandoned the role of a strategic staff. Here they know in detail what is "ailing" almost every piece of equipment, but they cannot look into the future.

"We have no clarity here," agrees the chief of the VPO, V. G. Zlokazov. "The superpowerful equipment with 255 kA, which is planned for the Sayansk shops, cannot be used. It has not shown itself well. And they have not managed to work out the new designs, although the documentation was to have been prepared ahead of time. Proposals have been sent to the USSR Council of Ministers concerning accelerating the tests on the new equipment. If they go well, the road is opened up to us...."

This road was opened up as early as the 1930's at the Volkov Aluminum Plant right next to VAMI. They were the first to apply technology with roasted anodes in those years. It is strange that this plant did not become a subbranch testing ground for working out new technology, where it would be possible to bring new designs of equipment to the point where they would be suitable for series production.

#### Automated Irresponsibility

A rare unanimous opinion among the enterprise, the branch institute, the VPO and the ministry can be seen only when the conversation comes around to automation of technological processes. Previously at aluminum plants there was a simpler ASU TP which regulated only one parameter of the process. The ASU TP Elektroliz, which was to have comprehensively included these parameters and reduced manual labor and reduced the expenditure of raw material and electric energy, was introduced at TadAZ and did not work there. They are now working on it in Sayansk. Like the technological equipment, they began to introduce the system fully all at once, without having tested it on a limited object. The results are modest so far. The ASU TP at SaAZ so far, like the old simple system, automates only one parameter. And they say the work is close to completion. But this is only function and the completion of the work for the other three have been put off for an indefinite period of time. And specialists think that the technical, technological and scientific difficulties are so great that it is even impossible to set a date. Yet the system is being accepted for industrial operation. The die has been cast.

For the best world level they have one center for control for 12 parameters. There is a computer for a group of vats or for 180 sets of equipment and each electrolyzer has a microprocessor, and at a higher level there is the central computer. Such decentralized two-level systems abroad help to considerably reduce the number of service personnel in the electrolysis shops.

So far we are only talking about them. And somehow we have lost sight of the fact that the ASU TP has nobody apparently in charge of it. The general developer here is also VAMI, which has a special division. For the development of material supply they have enlisted the Leningrad Proyektavtomatika Institute and the Tashkent Tsvetmetalektroproyekt. The startup in adjustment work is handled by a number of other organizations. But VAMI has no experimental base where it would be possible to test the automated equipment. The plant workers have their own requirements for the ASU TP, but they do not have the possibility of influencing the institute's developments. Finally, Proyektavtomatika automates the process in more than just the aluminum industry and it thinks that, since only part of the process is being handled by its specialists, the technology does not pertain to them. Everyone is responsible for his own "peace," and nobody is responsible for the whole thing. But the plant workers all agree: let it be with automation or without it--but let us produce metal.

"You write about that!" they told me in the VPO. "Why must we non-specialists work on the ASU and the specialized department--the Ministry of Instrument Making, Automation Equipment and Control Systems--has nothing to do with it?"

It is a fair question....

The ASU TP should control particularly the process of feeding aluminum (APG). This equipment was working poorly at TadAZ but they used it at SaAZ as well. Why? For the same reason that the electrolyzers had not shown their best side. There were no other developments: more likely, they existed--and systems of a different type had been tested, including the plant's suggestions. But since everything was not clear with them they decided that a known evil is one that is unknown.

It subsequently became clear that because of the shortcomings in the design of the vats it is generally impossible to use such an APG: when a large portion of aluminum is placed in the vat, the metal splashes. Moreover, a number of technical defects were found in the very system of this type of APG. In brief, at the Sayansk Plant they decided to reject the APG of the rod type. Specialists at Proyektavtomatika know about this but they still automate this process--they have their technical assignment. A division chief of this institute, A. L. Nistrov, answered the question about when and how automated feeding of aluminum will be introduced this way:

"Our work is to automate. Incidentally, the system is not complicated and has been tested successfully in many processes. But there if you look you will see technologists! Whether the system makes money or not is not our concern and it is not our fault...."

To automate something that will clearly not work and spend money without thinking, and, again, nobody except the director is worried about this. But the most surprising thing is that if the suggestions of the plant workers for equipping future facilities of the plant with new electrolyzers were accepted, the ASU TP in the form in which it is being developed would not be necessary at all.

"This is why we called the experimental design Tekhnolog," says A. M. Ivanov. "It is technological by nature. One does not need an individual system for feeding in aluminum. It comes into the electrolyzer through a pipeline and the proper doses are poured into the vat. The parameters of the process are regulated with a simple automatic instrument. This is a constituent part of the technology and it is simply impossible to work without it, with "manual conditions" as one can with the electrolyzers of the VAMI design."

Listening to A. M. Ivanov, one might think that we can and should make automated equipment in our industry so that it is impossible to operate without it. Then it would already be available in the first shop of the plant without any special prolonged disputes or discussions. And it seems strange that the imported automatic equipment all this time is working with the same path for feeding the aluminum.

#### And What Comes Tomorrow?

Penalties have been imposed on the management of the VAMI and the Soyuzalyuminiy VPO. A decision has been made concerning the development of experimental designs and the construction of a large experimental shop in Sayansk. But the question of the equipment for the new shops has not been resolved and it is difficult to say how it will be resolved. Taking into account the somewhat compulsory nature of the measures that have been taken and the mood in the VPO ("Still the VAMI sets of equipment are not bad, it is just necessary to perfect them," one continues to hear in one office. And more: "What if suddenly the plant designs do not work? What will we do?"), one must think that the small errors that are inevitable with new designs have been blown up and can be used to block the path to the light.

"Let the director do its own work," they say in the VPO. Actually, V. V. Strigo is involved in one thing and does not have time for others that are less important to the enterprise. Possibly all forces should have been thrown into the construction and startup of the plant and the formation of the collective. But the director can get no rest until he takes care of the main thing from his point of view, the result: the plant should not be operating at a loss right up until the 21st century!

I do not want this story to be perceived as a reiteration of the well-known situation, a good director and bad ministry and institute. The latter can be blamed for a good deal, but one can by no means say that they are aloof from plant business. On the contrary, perhaps they should rise up a little higher and think about the extent to which the plant and the technology correspond to the world level, and from these positions analyze what is taking place. But this vantage point has been lost and the comparison is with that which existed previously and generally that which is taking place all around. And if one looks with such eyes, it seems that nothing terrible is happening. Everything is the same as it is elsewhere or even better....

But this story is proceeding along with others about which we have read and heard many times. This was discussed at the 27th CPSU Congress. It has been written about in EKO also (let us name just the essay by I. Ognev, "The Fate of Technology," No 2, 1980, and "the difficult path of introduction," by A. F.

Koretskiy, No 3, 1983). Just the criticism of the equipment created by VAMI at the June (1985) Conference on Scientific and Technical Progress forced the institute and ministry to take certain steps. The very fact that these stories are repeated leads to the idea that the sources of the contradictions lie deeper than the merits or shortcomings of the people who are in charge of various departments, their attitude toward their work or their qualifications, although one could say a good deal about these as well.

One can understand the contradictions between the new and the old at enterprises that are in operation where stability of production is necessary. But at plants like SaAZ there is some doubt about the stability of management which is oriented toward yesterday and today. What will happen tomorrow? It is very troublesome, and there is no time to think about this in the organizational or scientific staffs of the branch that have lost or have never played a strategic role.

Up to this point the branch institutes do not bring their "scientific themes" to the point of introduction and their well-being does not depend on the expenditure of funds acquired for new technology, and they are not interested either in reducing the costs of technology or in "catching on the run" all technological innovations which promise an advantage. Whether the new production operates with a profit or a loss is not an automatic barrier for the ministry either. The money belongs to the state, even if there are immense losses, and who will make up for it and how, who will bear responsibility and with what will they pay? At best the guilty parties will lose their bonuses or there will be compensation in the amount of several salaries. But are these sums really comparable? The head institutes and VPO should bear responsibility for the technical level of the subbranch. The solution lies with the creation of an NPO, competition of directions, and subordination of branch science to the needs of production.

The path from development to introduction is too long--for sets of equipment for SaAZ it was more than 10 years. In the VPO they think that this is a "legitimate" time period and that things cannot be done any faster. But then the plan inevitably suggests solutions from the past. And the monopolistic position of the institutes which autocratically "turn" the entire subbranch is a nutritive environment for such a state of affairs. The plants must be given greater rights and independence here. Why not create an NPO on the basis of aluminum plants of Eastern Siberia? There is a scientific and practical base for this, and there are many technical and technological ideas. But so far the suggestion is only being contemplated and discussed, although its advantages are obvious.

Even if the basic sets of equipment on the whole correspond to the leading directions, there is no complex of technologies. The accompanying auxiliary equipment is considered to be secondary. And it is a difficult thing to enlist other ministries and scientific institutions in the creation of new equipment, materials and instruments for new technological processes.

Acquiring imported technical equipment and technology is not the answer either. There immediately arises the problem of reproduction and repair of the imported equipment. It will work for 4-5 years--and then what if it is

purchased abroad but not in parts, as was done at SaAZ? There in the shops for roasted anodes everything was purchased except for the furnaces. In the first electrolysis shop the technological connections between the imported and domestic equipment are not exactly correct.

The new technology for the production of aluminum will gradually extend to old aluminum plants of the country. For the time being, as they told us in the ministry, it is suggested that the Volgograd Plant be reconstructed. A fairly significant problem is that the changeover of the old enterprises to more effective, resource-saving and ecologically pure technology is being impeded by the modest results of those plants where this technology is being applied.

As was stated in one of the protocols of the technical council, which was signed by leading specialists of the two plants, one cannot perpetuate the existing situation. This could undermine the aluminum industry by the end of the five-year plan. Perhaps they put this too strongly, but the future technical image of SaAZ and all aluminum plants of the country depends on today's decisions.

An engineering center, the first in the subbranch, has now been created at SaAZ. A foundation is being laid for an experimental shop where they will test and work out designs of sets of equipment. Before this, such a shop, also the first, was composed of sections in existing shops where it was difficult to test anything or to change the current. Because of the position of the head institute and the lack of support from the VPO they lost the opportunity to install developed sets of equipment at SaAZ so that the plant could operate normally from the very first. Instead, only one shop was constructed. What will be the fate of SaAZ? The plant workers have many ideas, and a good deal has been done in spite of the difficult conditions. We hope that time will not be wasted and that the obstacles on the path to the new will be removed. And everything at Sayansk will be different from the way it has been up to this point at aluminum plants of the country.

When you enter today's electrolysis plant at Sayanogorsk, the most modern of the hundred that are in operation in the country, do not forget to take off your watch at the entrance, for otherwise it will stop because of the strong magnetic field. This field mixes the imperturbable metal in the electrolyzers.

When speaking with participants in this long story who calmly tell about the numerous economically disturbing episodes, one feels that time has stopped somewhere in the 1960's. To be sure, the director of SaAZ, along with his numerous assistants, is trying to move the hands of the watch manually and to set the right time. But in our age of the scientific and technical revolution there have long been watches which do not need to be set.

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## MINISTER RESPONDS TO PREVIOUS ARTICLES

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 70-71

[Response to Article "Gulliver's Lilliputian Steps," EKO, No 12, 1985, and the Interview with the director of the Sayansk Aluminum Plant, V. V. Strigo, "Heavy Aluminum," EKO, No 1, 1986, by P. P. Selskiy, deputy minister: "The Five-Year Rhythm of Two Construction Projects"]

[Text] The Ministry of Construction of Heavy Industry Enterprises, having considered the materials in the magazine devoted to problems of construction of two new construction projects in Krasnoyarsk Kray, announces the following.

At the Krastyazhmarsh PO during 1979-1985 250,000 square meters of production space were constructed and put into operation, and capacities were created for producing 31 EKG-12.5 excavators. At the present time capacities have been released for producing one ESh-40-85 walking excavator. A large residential area is being constructed for workers of the association.

But there was delay in the construction and installation work. The assignment established for January 1959 was not completely fulfilled. The capital investments allotted for the construction project and the arrears in the performance of construction and installation work made it impossible to complete the construction of the first section of the plant in 1984. It was not envisioned for the construction of the metallurgical shops for producing cast steel and thermal forged products to get ahead. The main reasons were the regular shortage of skilled workers under the conditions of Krasnoyarsk Kray and also the delay in creating a production base for the construction site and in releasing housing for newly arrived workers as well as the delay in issuing planning documentation.

The ministry issued an order according to which construction materials, elements and individual items were to be allotted especially for the construction project. In order to accelerate the construction of plant facilities, the material and technical resources are being constructed in the startup facilities and the most important reserve facilities. In 1986 special attention was devoted to the introduction of progressive forms of organization and stimulation of labor and the development of the initiative of labor collectives. The fleet of highly productive machines and mechanisms was

reinforced. There are 5,500 workers employed at the construction site, and another 1,800 will be sent there.

The state of affairs in the construction of the Sayansk Aluminum Plant is as follows.

The estimated cost of construction and installation work at the Sayansk Aluminum Plant is 625 million rubles. Under the 10th Five-Year Plan the plan for construction and installation work was fulfilled, 26.1 rubles were assimilated, and 37,600 square meters of dwelling space were put into operation while the plan was for 22,000. During 1981-1985 for construction at SaAZ the construction and installation work amounted to 233 million rubles, 189,300 square meters of dwelling space were put into operation and there was a considerable increase as compared to the preceding five-year plan. But still the plan for construction and installation work was not fulfilled. The main reasons were delays in the planning of the plant, the reworking of the technological part of the plan, the fact that the client was late in supplying equipment and materials, and also difficulties in staffing the construction site with personnel.

During 1986-1990 the USSR Ministry of Construction of Heavy Industry Enterprises must carry out 373 million rubles' worth of construction and installation work and introduce seven sets of facilities for electrolysis and three lines for producing roasted anodes. The trust will be given assistance in staffing the project with workers, providing housing for them, and accelerating the development of the production base. Measures are being taken to increase the capacity of the Sayanalyumtyazhstroy Trust and fulfilling the assignments for 1986. All the necessary materials and elements have been allotted for the construction site and 4,000 workers are being sent there. But problems of providing the construction site with technical documentation, equipment and material are being resolved with delay by the clients, the USSR Ministry of Nonferrous Metallurgy and the Directors of SaAZ. Up to this point they have not decided which technological sets will be installed in the electrolysis facility No 2, which will be put into operation in 1987, they have no gantry cranes which are necessary for installing this equipment, and there are interruptions in the deliveries of refractory materials.

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## SOVIET MATHEMATICIAN AND ECONOMIST HONORED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 p 72

[Article: "An Outstanding Soviet Mathematician and Economist" ]

[Text] 19 January 1987 is the 75th anniversary of the birth of the outstanding mathematician and economist, winner of the Lenin, State and Nobel Prizes, Academician Leonid Vitalyevich Kantorovich (1912-1986). L. V. Kantorovich's research has enriched both mathematics and economics with fundamental results that are of primary significance. The mathematical programming he discovered is used widely for solving various problems in economics, physics, energy engineering, geology, biology, mechanics and the theory of management. L. V. Kantorovich is one of the founders of the modern economic-mathematical direction in economic science.

He created large scientific schools in the area of functional analysis, computer mathematics, mathematical economics and optimal planning of the national economy.

L. V. Kantorovich enjoyed a great deal of authority in world science. He was elected to be a member of a number of foreign academies and received honorary doctorates from many universities.

His scientific contribution amounts to more than just his articles and books. It also includes the work of his students and a multitude of followers, for whom L. V. Kantorovich's ideas and communication with him determined the nature of scientific thinking and their activity for the rest of their lives. There is also the instructive life path of L. V. Kantorovich as an innovative scientist, a pioneer and a fighter.

We offer for the reader's attention a selection of articles devoted to L. V. Kantorovich.

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## NEW TREND IN ECONOMIC SCIENCE DESCRIBED

Novosibirsk EKONOMIKA I ORGANIZATSIIA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 73-77

[Article by D. M. Kazakevich, doctor of economic sciences (Novosibirsk): "A New Direction in Economic Science"]

[Text] L. V. Kantorovich belongs to the pleiad of scientists who have established fundamental new trends in various areas of science. In addition to classical results in modern mathematics, he has created fundamental work which has opened up a new direction in economic science. The first and also the landmark scientific result in this area was the development in 1938 of a method for solving the problem of optimal loading of equipment. This problem is one of a large group of planning and economic problems for which there were no methods of solution at that time. The work on the problem led to the creation of a principally new, optimal approach to production planning and also as principally new mathematical instrument which subsequently came to be called linear programming.

The presentation of the fundamentals of the theory of optimal production planning and linear programming was the subject of the papers by L. V. Kantorovich which were generalized in the well-known work of 1939, "Mathematical Methods of Organizing and Planning Production." Three appendices to the presentation of the theory of linear programming and a substantiation of the existence of resolution factors were devoted to mathematical substantiation of the methods that were proposed.

L. V. Kantorovich was the first to discover linear programming in world science. The priority of Soviet science in this area is generally recognized. Research in the area of linear programming in the United States was not begun until the end of the 1940's. The simplex method of Danzig, which is similar to Kantorovich's method of solving problems by linear programming, was developed a decade later.

The discovery of linear programming was made at the juncture of two sciences--mathematics and economics--and was the first step and the impetus for research by L. V. Kantorovich himself, his students and his followers in a broad range of optimization economic problems and methods of solving them. And the main thing was that the work of 1939 laid the basis for the development of the

theory and methodology of the optimal approach to control of economic processes.

L. V. Kantorovich not only laid the foundation for the modern theory of optimal planning for the socialist economy, but also developed a number of most important points in it. His major monograph, "Economic Calculation of the Best Utilization of Resources" was devoted to a thorough presentation of the fundamental ideas of this theory. The pivotal point of the book is the formulation of the basic problem of production planning and its dynamic variant, which take into account the most important features of planning in a socialist economy as well as the substantiation of objectively conditioned or optimal evaluations. Through his interpretation of resolution factors as optimal evaluations, L. V. Kantorovich created the foundations of optimization economic and mathematical analysis of a broad range of fundamental economic problems.

One can say without exaggeration that the consistent and strict substantiation of the optimal approach to economics and the consideration of all economic processes from the standpoint of optimization marked a turning point in such most important areas of economics as the realization of principles of goal-setting and planning in keeping with the basic economic law of socialism, measurement of the effectiveness of public production, price setting, methods of realization in the management of the economy of the principle of democratic centralism, and so forth.

The fundamental works of L. V. Kantorovich, V. S. Nemchinov and V. V. Novozhilov in the area of the theory and methodology of the optimal approach in planned management of the economy are associated with a qualitatively new stage in the development of economic science. It was predictable that the authors of these works would be awarded the Lenin Prize in 1965.

L. V. Kantorovich receives a great deal of credit for establishing a new economic thinking which in our day has been developed in connection with the tasks that have been set for th for changing over from primarily administrative to mainly economic methods of planned management of the national economy. Economic methods presuppose a changeover of enterprise to complete cost accounting and management of their activ'ty increasingly with the help of long-term economic normatives. Greater requirements are placed on prices and normatives of the effectiveness of the utilization of production resources, on the basis of which wage rates for them should be established. The discovery of the results of duality when solving economic problems of optimization of the national economic plan, that is, the possibility of obtaining sufficiently stable dual variables--optimal evaluations of products and resources--is of principal significance. It has been proved that the formation of evaluations adequately depicts the process of the formation in the national economy of complete expenditures on the production of useful products, and the evaluations themselves can serve as base numerical values when determining prices, normatives of the effectiveness of resources and cost accounting payment rates for the utilization of state resources.

Previously views concerning the unmodified value under socialism prevailed, that is, the concept of the formation of value through direct average

expenditures for obtaining a product immediately in the sphere of its production, regardless of the degree of satisfaction of the need. L. V. Kantorovich's works contribute to rejecting this and changing over to the socioeconomic concept of socially necessary expenditures of labor (ONZT) and value, which corresponds to the Marxist theory of labor value for the conditions of developed commodity and monetary relations. In order to understand this completely at the present time, it was necessary to recognize that under the conditions of socialism commodity and monetary relations are widely used in their new form with a content that is inherent in socialism, that commodity and monetary relations are developing further and that value has its own modification that is inherent in planned management. At the juncture of mathematical and economic theoretical research L. V. Kantorovich essentially managed to discover the nature of this modification and propose a numerical method of determining the base of the price as a monetary form of value. This exerted a significant influence on the formation of a number of modern tenets of political economics of socialism and is an outstanding contribution to the improvement of the practice of planned price-setting.

From the standpoint of the theory of duality L. V. Kantorovich, as early as the 1950's, suggested calculating the optimal value of capital investments for the planned period. He gave its economic interpretation and showed its value in economic management. This was a scientifically substantiated approach to determining the numerical value of the unified national economic normative of effectiveness of the utilization of capital investments which was largely determined by the needs of the time. L. V. Kantorovich gave a fully developed theoretical interpretation of this normative in 1967 in the work entitled "A Dynamic Model of Optimal Planning," where he formulated the following conclusion: "In the process of locating the optimal long-range plan, one determines the norm of effectiveness of free capital investments which serves as a base for deriving expenditures at various times and their results and for calculating the effectiveness of capital investments."

If this approach were fully realized in practice it would make it possible to deepen cost accounting and extend it to reproduction, having decentralized a significant proportion of the decisions concerning the utilization of capital investments for purposes of reconstruction and technical reequipment of enterprises. This possibility follows from the fact that the existence of a normative of effectiveness established when developing at the macrolevel the plan for the entire national economy makes it possible, by doing local calculations of effectiveness at microlevels using this normative, to select variants of capital investments that are applicable from the standpoint of national economic effectiveness.

A similar role was to have been played by the normatives of the effectiveness of natural resources, the methodology for whose development, from the standpoint of Marxist theory of differential rent, was also suggested for the first time by L. V. Kantorovich. He showed that the widespread evaluation of natural resources based only on the initial expenditures of labor on putting them into operation was fundamentally incorrect since it frequently leads to a situation where resources that are most effective for the national economy appear to be the least valuable. And this does not stimulate but, on the contrary, impedes the changeover to resource-saving technologies. L. V.

Kantorovich's proposals are directed toward the creation of an anti-expenditure economic mechanism and, in particular, an economic mechanism for efficient utilization of nature.

It was typical of L. V. Kantorovich's position that, having created a strictly scientific methodology for determining prices and normatives of the effectiveness of resources, he allowed temporary utilization and practice of similar approaches if they were in the mainstream of the correct direction of the improvement of the economic mechanism. In particular, when actively working on the board of the USSR State Committee for Prices, L. V. Kantorovich persistently suggested rejecting the understanding of the ONZT as average actual expenditures and for the time being changing over to approximately principles of the optimal approach in price setting. In his well-known work of 1979, "Price Setting and the Technical Process," he defined these principles as follows: 1) intercoordinated development of a plan for the development of the national economy and the price system; 2) socially necessary expenditures on the product as the basis for prices should include complete national economic expenditures of all kinds: both current--labor and material--and funded, including debts for capital investments, limited natural resources and scientific potential; 3) the price should take into account the social effectiveness of the products and their consumer qualities.

L. V. Kantorovich devoted a great deal of attention to the introduction of the methods he developed into economic practice. His works on efficient cutting of materials were widely used. Beginning in 1964 he was in charge of the work for introducing methods of calculating the optimal loading of rolling mills in the country. The automated control system "AUS-Metal" developed in the USSR Gosnab includes as a basic block the optimization algorithm for loading. A number of applied works were related to agriculture, including the optimization of the utilization of technical equipment.

Being a member of the USSR State Committee for Science and Technology and chairman of the special council created by the committee, L. V. Kantorovich did a large amount of organizational work directed toward improvement of planning and management of the national economy on the basis of the utilization of optimization methods. L. V. Kantorovich's activity in the USSR State Committee for Prices undoubtedly exerted a decisive influence on the practice of price setting. He also did a great deal as the chairman of the scientific counsel of the USSR Academy of Sciences for Transportation. His work in the Presidium of the Scientific and Technical Counsel of the USSR Ministry of Railways is also well-known.

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## KANTOROVICH'S RESEARCH METHODS DESCRIBED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 77-83

[Article by V. L. Makarov, corresponding member of the USSR Academy of Sciences (Moscow): "An In-Depth Researcher"]

[Text] I became acquainted with Leonid Vitalyevich in 1960 when I went to him asking for a job at the mathematical-economics division of the Institute of Mathematics of the Siberian Branch of the USSR Academy of Sciences. And after that I worked for 10 years under his direct leadership, in constant contact with him, almost every day, and sometimes many hours a day. In 1971 Leonid Vitalyevich moved to Moscow, but we maintained close contact until the last days of his life. Together we wrote dozens of scientific articles and reports on various conferences and symposiums. I personally saw Leonid Vitalyevich in the process of research. Therefore I think I have the right to share my ideas on him. Of course, this is my subjective perception of him as a scientific researcher and as a creative personality.

Looking now at this aspect of Leonid Vitalyevich's life I can say with confidence that he was always aware of his position in history. Through some special sense, intuitively he understood what was fundamental and what was transitory and contrived. So many times I heard ideas from him about the meaning of writing scientific articles, especially when it came to some work that had to be published quickly. When Leonid Vitalyevich heard that it was necessary to accelerate a publication because otherwise it would become outdated, he always had one answer: "The article does not deserve to be published at all. A scholarly article is not a piece of information in a newspaper about current events, but a result that enriches science," he said. He did not allow haste in such questions at all. Even when it came to establishing priority. Quality was always in first place.

The same situation repeated itself time and again. I would think that an article had been completed, but Leonid Vitalyevich would say: "Let us wait a little while. Let it sit for a little bit and then we will take a look at it with a fresh view, and after that we can send it off to the editors." No circumstances could shake him from this rule. Here is the last example. When Leonid Vitalyevich was already fatally ill and knew it he was in charge of a work group of specialists of the USSR Academy of Sciences and the State

Committee for Science and Technology for Reworking Methods for Evaluating the Economic Effectiveness of New Technical Equipment. The deadlines were strict. But because, as everybody knows, the subject was so difficult, they did not obtain a concise and clear document. It was necessary to maneuver between scientific purity of the concept and the traditions and dogmas of economic practice. Leonid Vitalyevich made no compromises here either. He rejected all palliative formulations, in spite of the deadlines that were approaching and the assurances that this formulation was temporary, that it would be changed later, and so forth.

The quality of being fundamental was always felt in Leonid Vitalyevich's approaches. It seems to me that this is the most typical feature of great people and as for L. V. Kantorovich, history unquestionably confirms this.

Now about something else. L. V. Kantorovich, along with V. S. Nemchinov and V. V. Novozhilov is correctly considered the founder of the economic and mathematical area in economic science. Of these three only he was a mathematician from the very beginning. And a mathematician of the very highest class. He is responsible for first-class results in functional analysis, the theory of functions, and computer mathematics. He has a number of large works on set theory, the theory of computer programming and so forth. Alone and with his coauthors he wrote about a dozen significant monographs on mathematics. Finally, he was elected an academician in the mathematics department. It would seem that everything is clear. Leonid Vitalyevich is a mathematician to his very bones, with all the specific mode of thinking and methods of investigating problems. And he is an economist only to the extent that he applied his mathematical methods and his mathematical art to economic problems.

In reality that is not so. The outstanding phenomenon of L. V. Kantorovich is that he was at the same time an eminent economist and scholar who essentially changed the understanding of economic phenomena, seriously changed economic thinking, and became the founder of his own economics school. I know several people who are now well-known economists who recognize that their views changed radically after they became familiar with the works of L. V. Kantorovich.

Where, in my opinion, was his influence on modern economic thinking mainly manifested? I think that it came from the methodological principle of the constructability of the economic system that is internally inherent in a socialist society. Since socialism, unlike previous formations, has an author --Marxist-Leninist teachings--its economic system must also be constructed deliberately on the basis of theoretical concepts of this teaching. Further, Leonid Vitalyevich probably thought so. For the time being, using a mental (mathematical!) device, let us separate the production-technological part of the economy from the part that pertains to production-economic and social relations, and let us direct our view to the first part. Now another mental device. Let us assume that we are omnipotent. How then can we best construct the production-technological part? Here we end up with a problem which can be formulated and resolved mathematically. Leonid Vitalyevich, in his works, gave the first formulation and method of solving the problem of optimal construction (planning) of the production-technological part of the economic

system. In the final analysis he developed an entire system of solving these problems and thus a reference point appeared: the theoretically best (optimal) condition of the economy (more precisely, of its production-technological part). They studied in sufficient detail the properties of these conditions, the methods of calculating them and so forth.

We can proceed further in our mental constructions, and this movement was carried out and is being carried out, namely: it is possible to pose the question of how production-economic and social relations should be so that they realize or contribute to the realization of the given best condition. This problem is immeasurably more difficult than the first. Here it is no longer enough to use such concepts as the needs of people. There arise concepts of the economic interests of the most varied groups of participants in the production process. Leonid Vitalyevich obviously thought long and hard about economic mechanisms that are adequate to socialism and provide for movement toward the best condition. It was precisely as an economist that in his analysis he could land on a schema in which as though separately there is an optimal condition of the economy and production relations, and economic mechanism and so forth which provide or do not provide for this optimal condition. Such a mental device of dividing concepts, I repeat, is typical of the mathematician. In particular, it is convenient for constructing models of the economy. But as an economist Leonid Vitalyevich always felt that in reality these concepts are inseparable. One directly influences the other. For instance, the very concept of the optimum is formed and changes depending on the concrete forms and structure of production relations.

Leonid Vitalyevich said that he would prefer a nonoptimal condition but one which meets the principles of social justice. This statement directly shows his deep understanding of the relationship between the optimum and production and distribution relations, which was much deeper than he is sometimes given credit for.

Now about commodity and monetary relations as means of providing for movement toward the best condition of the economy. He formulated this attitude toward commodity and monetary relations under socialism: the broader the sphere affected by economic measurements, the better in the sense that there is more information for substantiated decisions. Economic indicators like prices, tariffs, normatives and so forth, in his opinion, should be utilized much more extensively than they are now. Suffice it to recall his proposals concerning evaluation of labor and natural resources, water, land, housing conditions, production and nonproduction capital, deposits, time and so forth. But the economic evaluation and the commodity and monetary relations are, in his opinion, different things. Commodity and monetary relations under socialism are, as it were, less pitiless than under capitalism. They have a certain element of being a gain, an element of being unnatural, something like a sense that it is always possible to correct things in a different way--by intervention from above and so forth. Sometimes Leonid Vitalyevich expressed his understanding of economic measurements and commodity and monetary relations in a joking or ironic form. For example, he suggested that economic managers introduce a personal account in which they would recall all profit and losses related to their activity as managers. It would turn out to be something like double-entry bookkeeping. Certain managers would be (on paper)

millionaires, while others would be bankrupt. In Leonid Vitalyevich's opinion, this information would be extremely useful when making decisions, including those regarding personnel.

Or another example. Leonid Vitalyevich imagined a buffet (store) in a communist society with an indication of prices for all the products. A person takes everything he needs without paying, but he takes this price into account as an indicator of the expenditures of the society on the production of products. The communist awareness is manifested in the fact that expensive products are taken less frequently, say, for days of celebration. That is, the economic evaluation is broader and more universal than pure commodity and monetary relations. And in the socialist society there is the problem of the interaction between economic measurements and evaluations and commodity and monetary relations, and not a problem of the existence or nonexistence of commodity and monetary relations. The economic evaluation can and should, in his opinion, be done, including in those spheres which are partially or completely beyond commodity and monetary relations: public health, education, culture and so forth.

In recent years in this area Leonid Vitalyevich was especially interested in the question of the economic evaluation of scientific and technical progress. This, as we know, is an extremely complicated question. It is also complicated in the sphere of the theoretical model. In addition to the essential significance of the factor of indeterminacy, a complicating circumstance is the fact that in the economic and mathematical model there is no corresponding ingredient which would reflect scientific and technical progress or an objectively conditioned evaluation which could be the basis for the corresponding calculations. New knowledge, new technologies, production methods and new kinds of products are not given an objective economic evaluation according to the schema that is traditional in economic and mathematical modeling similar to the way an evaluation is given, say, to capital investments, natural resources, labor, and the factors of time and space. Leonid Vitalyevich had apparently always understood this circumstance. But initially he thought that a correct evaluation could be given to new knowledge (in the broad sense) by accounting more precisely for the factors of indeterminacy, risk and discreteness. It is known, for example, that indefiniteness increases the economic evaluation of new knowledge, from which it follows that new knowledge can be produced effectively even when according to ordinary methods of comparison of expenditures and results, it is attained at a loss. The more he thought about this problem the more he became convinced that such an explanation is inadequate, and that it misses something essential. His intuition and rough numerical estimates show that the standard calculation strongly reduces the effectiveness of scientific and technical development, especially principally new developments with unclear prospects for practical utilization. Therefore, recently he was developing the idea that a technical innovation, when it is created, produces, as it were, two effects. One effect is the usual one obtained from the utilization of the given innovation in production. But the other effect is unusual. This is new knowledge which appears along with the given innovation. The new knowledge is a contribution to scientific and technical progress as a whole. It is difficult and sometimes simply impossible to indicate the precise use for it. If one were to realize this idea in an economic and mathematical model, there

would appear an unusual new ingredient, a new "production" factor whose consumer would be the society as a whole in the form of the state. This ingredient--new knowledge--is given an objectively conditioned evaluation which is also the second variable of the economic effect obtained from the technical, and sometimes not necessarily technical, innovation that is under consideration.

I should also like to express certain ideas about L. V. Kantorovich's practical work.

As we know, for many years Leonid Vitalyevich was a member of the State Committee for Science and Technology, was on various commissions for transportation, price setting and material and technical supply, he participated in the work of the State Board of Expertise of the USSR Gosplan, and so forth--one cannot list them all. Probably few know that the current rate for taxes was suggested and substantiated by him. Or, for example, Leonid Vitalyevich was one of the first to understand the significance of the Kansk-Achinsk Coal Basin for the country's energy balance. Many practical ideas and proposals of L. V. Kantorovich, unfortunately, have not yet been realized, although for a number of years he was extremely persistent in bringing them up.

Among these proposals one can mention his system of economic normatives and tariffs. For example, he suggested that transportation tariffs be made essentially nonlinear, depending on the distance, which was to have become an effective economic lever for streamlining shipments. And his proposals concerning payment for production capital and natural resources, including, for example, for water and for categories of labor resources that are in short supply and incomplete construction? These, after all, were proposals of the 1960's! Some things have been partially realized (payment for funds), some things are actively being discussed even now (payment for water), and some things have been forgotten (the system of rent payments).

In recent years, Leonid Vitalyevich headed the scientific council for optimization in automated control systems under the State Committee for Science and Technology. This council's goal was to coordinate the activity and contribute to the development and application of optimization calculations at all levels of the national economy. In Leonid Vitalyevich's opinion, there are two aspects to the introduction of optimization algorithms and programs. One is the creation of a favorable economic environment for this introduction, whereby the organizations are interested in applying optimization calculations. The second is the actually technological aspect. Optimization algorithms and programs are a new element in the technology for planning and management. But they must be built in to this technology. The question is not simple and it is not economic. Here there are technical and administrative and methodological problems. Leonid Vitalyevich drew attention to this repeatedly at the council and said that everything could not be included in the first aspect. One could expect that as soon as there was an economic interest in the introduction of optimization programs things would proceed of their own accord. Based on his initial point concerning the constructibility of an economic system of the socialist society, L. V. Kantorovich thought that optimization algorithms and programs should become an

organic part of the system of planning and management at all levels, and an organic part not even in the economic sense, but in the purely technological sense. To put it roughly, if the organization algorithm is not used the technology of planning and management would be violated.

Mentally turning back to the life of Leonid Vitalyevich Kantorovich, one is clearly aware of the need for an in-depth study of his legacy. Much has been registered in the press and it will not be lost. But much lives also in the memory of his colleagues, students and comrades. This latter must also be registered as completely as possible while the memory of Leonid Vitalyevich is still fresh.

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## KANTOROVICH SEEN AS PERSISTENT WORKER

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 84-85

[Article by N. Ya. Petrakov, corresponding member of the USSR Academy of Sciences (Moscow): "An Uncompromising Fighter"]

[Text] I consider one of the greatest successes in my life to be my lengthy acquaintance with Leonid Vitalyevich Kantorovich.

I must say that he entered my life a couple of years before our first meeting in person. His well-known book "Economic Calculation of the Best Utilization of Resources" literally struck me with its extraordinariness. In order to understand and evaluate the significance of this feeling from Leonid Vitalyevich's book for a young specialist who has just completed the economics faculty of MGU, one must have a good idea of the economic literature of the 1950's and the content of the training courses of economics faculties and institutes. The book contained definitions and general ideas about the "requirements" of various economic laws and about how "they control" social development. The book was about ACTION, about how to utilize the limited production capabilities prudently and with the maximum effectiveness and how to control the economy efficiently. In terms of its structure and the nature of the presentation of the material the book looked (and I think Leonid Vitalyevich's cunning was manifested here) like a kind of textbook for public "housekeeping" [Footnote 1]. But in terms of content it was the most profound theoretical research, which had been published with a great deal of delay, but not only was it not outdated, but by the time it was published it was even more crucial than it had been during the period of its creation. One must admit that many scholars responsible for the development of economic science during the postwar period had "put their hand" to the appearance of this paradox. L. V. Kantorovich's work liberated the economic thinking of a large detachment of Soviet economists.

On a personal plane, Leonid Vitalyevich, like any highly talented individual, combined contrasting character traits harmoniously, without any internal struggle. He was extremely kind to people. I not only have never met but I have not even heard of a single person whom Leonid Vitalyevich has offended, willingly or not. In communication with people around him he was always tactful and careful in selecting his words, even during a short scientific

polemic when his opponents sometimes "broke out" with sharp statements or, as they say, "attached labels" which were far from inoffensive. At the same time L. V. Kantorovich was uncompromising in defending his scientific position. And it did not make any difference to him whether his audience understood him or if his words were a "voice howling in the desert." One got the impression that he was not bothered if his listeners were skeptical or even hostile. I worked with Leonid Vitalyevich for many years in the Bureau of the Scientific Council for Price Setting, and I can attest to how, while recognizing the futility of his efforts, he did not pass up a single opportunity to convince the leadership of the State Committee for Prices to utilize his ideas for restructuring the system of price setting on a scientific basis--this same restructuring, the need for which the 27th CPSU Congress has now devoted the most serious attention.

Leonid Vitalyevich combined a certain aloofness and introspection which are necessary for the creative personality with a keen perception of daily life. He was unusually precise in his evaluations of human qualities, not only of scientists, but also of "simple mortals." Moreover, I dare say that Leonid Vitalyevich was artistic on the inside. I shall give just one example which is well-known to many of his colleagues. At meetings of scientific councils and in scientific debates L. V. Kantorovich reacted very keenly to any fresh idea, interesting statement of a problem or new hypothesis. But there were cases when in the middle of an orator's speech he "suddenly" yawned and sometimes even, for greater convincingness, snored lightly. But as soon as the speaker stopped his smooth speech, Leonid Vitalyevich instantly came to life and asked a couple of questions or threw out a retort that immediately crushed the argument. People who knew this device winked at each other: if Kantorovich "fell asleep" it meant that things would be interesting.

Leonid Vitalyevich's tenderness and vulnerability were combined--in a surprising way they were organically combined--with his exceptional militancy. The less a chance for success, the more his militant qualities were manifested. Once Leonid Vitalyevich taught me a good lesson. One important practical issue was being resolved. An important bureaucrat on whom almost everything depended gave a negative answer. In a conversation with Leonid Vitalyevich, on the basis of the situation that had arisen, I expressed the opinion that there was not much point in continuing to fight, in any case at this stage. "You are profoundly mistaken," answered Leonid Vitalyevich. "It is very good that I received not an evasive but a categorically negative answer. Now my hands are untied!"

#### FOOTNOTE

1. Literal translation of the term "economics."

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## SCIENTISTS REMEMBER LIFE WITH KANTOROVICH

Novosibirsk EKONOMIKA I ORGANIZATSIIA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 86-92

[Article by G. Sh. Rubinshteyn and S. S. Kutateladze, doctors of physico-mathematical sciences, Institute of Mathematics of the Siberian Branch of the USSR Academy of Sciences, recorded and prepared by D. Shpilfoygel: "In the Destiny of Leonid Vitalyevich Appeared a Historical Pattern..."]

[Text] G. Sh. Rubinshteyn. Leonid Vitalyevich Kantorovich is one of the outstanding scientists. It would be difficult to overestimate his contribution to the development of mathematics and economics. Therefore his research methods, the peculiarities of his thought, the organization of his interactions with students and his personality itself should be studied and will undoubtedly draw the attention of science experts.

Leonid Vitalyevich's mathematical abilities were manifested early. He entered the University at the age of 14 and completed it at 18. While still a student, he published about a dozen articles, including in French and Polish journals that were prestigious at that time.

At 21, that is, 3 years after he had completed the University, he was given the title of professor and a year later, without defending his dissertation, he was awarded the scholarly degree of doctor of physicomathematical sciences.

Among Leonid Vitalyevich's peculiarities as a researcher one must include first of all the ability to single out from a complicated problem a small task and investigate it, as a rule, using new constructs which at first glance seemed far from the goal but made it possible to clarify principally new aspects of the phenomenon.

What happened with the principally new direction of linear programming? Specialists of the laboratory of the Faner Trust asked mathematicians to show them a numerical method of solving the problem of distributing the production program among the machine tools. The task interested Leonid Vitalyevich, he began to work on it, and he not only discovered and substantiated a method of solving it (the method of resolution factors), but also discovered the typical feature of this problem for mass technical and economic practice. The main thing is that in the structure of the problem Leonid Vitalyevich saw a clear economic meaning, and it was deeper than the one produced by this concrete

task directly. He established that the o.o. (objectively conditioned) evaluations obtained in the process of solving the problem were inseparable from the optimal plan and were more stable than it was itself. The concept of the optimal plan and the role of o.o. evaluations turned out to be extremely fruitful, not only for the technical and economic sphere, but also for the socialist economy as a whole. Actually for his own economic ideas he, along with V. V. Novozhilov and V. S. Nemchinov, was awarded the Lenin Prize and, along with the American scientist T. Koopmans, was awarded the Nobel Prize.

S. S. Kutateladze. Leonid Vitalyevich worked on many of the largest problems of mathematics in his time. Mathematicians are familiar with his books which have become classics, "Methods of Approximation in Higher Analysis" (in conjunction with V. I. Krylov), "Functional Analysis and Semi-Ordered Spaces" (in conjunction with B. Z. Vulikh and A. G. Pinsker) and "Functional Analysis in Normed Spaces" (in conjunction with G. P. Akilov). Leonid Vitalyevich has a total of about 300 publications.

He singled out among his mathematical works cycles of research on descriptive theory of functions and the theory of sets, the constructive theory of functions, the methods of approximation in analysis, functional analysis, functional analysis and applied mathematics, linear programming, and computer equipment and programming. In all of these areas he received first-class, frequently fundamental results. In mathematics there are Kantorovich spaces, Kantorovich nuclei, the Newton-Kantorovich method, the Kantorovich variation method and numerous theorems of Kantorovich.

How can one explain such a broad range? Of course, by his talent and by his sense of his own power, but not only this. An important role was also played by Leonid Vitalyevich's civic position, his sense of personal responsibility for what was taking place in the country. He said that the "First All-Union Mathematics Congress," held in 1930, made a great impression on him. In order to get a sense of the atmosphere of the time, one can give one quotation from the program speech of the congress by Otto Yulyevich Shmidt: "In a country where socialism is being constructed, where it is necessary to be able to count, it is necessary...to have the ability to formulate mathematically the tasks that are facing everyone, the ability to approach each specific task fully armed with science, the ability to lead most economically and precisely, and this ability must be general property."

Leonid Vitalyevich was possibly the youngest participant in this congress--he was 18 at the time. But if one were to look at his publications in the next few years after the congress, it would not be hard to see in them a desire to respond to many of the most important things that were said at the congress. There is the sense that Leonid Vitalyevich was trying to make his way through all the most important problems facing all of Soviet science at the time.

Leonid Vitalyevich was in the vanguard from the very beginning. Therefore he managed to be the first to do a great deal or among the first. And this included such diverse areas as functional analysis, computer mathematics, linguistic programming, and in mathematical economics Leonid Vitalyevich became one of the founders, a classic.

Few know, for example, that L. V. Kantorovich created the first scientific division and faculty for computer mathematics in the country.

G. Sh. Rubinsteyn. The sense of responsibility that was so typical of Leonid Vitalyevich originated, it seems, in his childhood years. As a young talent, during the difficult 1920's he was supported by the government and received a special stipend. Later Leonid Vitalyevich said not without pride that even when he was 14 he was the breadwinner for his family. In the universities surround by his teachers and comrades in an atmosphere of creativity, his sense of responsibility became stronger. All this exerted an influence on his interest in applying mathematics as well. Leonid Vitalyevich himself thought that his process originated under the influence of the Peterburg-Leningrad School. In the University he paid a great deal of attention to lectures on political economics, history....

S. S. Kutateladze. Solutions to difficult problems and results of a record level are especially valued in mathematics. These are problems which have been posed a half-century or a century ago or even before that, and which have withstood the onslaught of many generations of mathematicians. And then this kind of problem is resolved. As a rule, to do this one uses very precise evaluations and contrives refined devices, in a word, high technology is put into operation.... Consequently, the person who solves such a problem attracts the attention of mathematicians.

Leonid Vitalyevich's gift was of a different type. He was a founder, a pioneer. He said of himself: "I cannot resolve difficult problems, I am a conceptualist."

He did not see his talent or himself in science in isolation from life; it was a part of life and he strove to work actively in it, and to live broadly, throughout the entire range. This was not in order to dig himself a corner and settle in. An active attitude toward life is typical of scientists of Leonid Vitalyevich's generation and older, for he was the youngest of those with whom he began. The country was being built, it was a new society, the fundamentals of modern science were being formed, and this spirit of the founders and of the first five-year plans grips talented young people.

This approach made creativity integrated and unified, in spite of the apparent diversity of the studies.

Leonid Vitalyevich once said that in fact there were two Kantoroviches--the mathematician and the economist--but they are Siamese twins, that is, they cannot be divided in two. He considered his main work to be the theory of ordered spaces, the theory of linear inequalities and linear programming. It is no accident that he worked on these literally during the same years--they are all a unified complex of ideas.

Leonid Vitalyevich has what is in my opinion an attractive article (along with M. K. Gavurin) under the very remarkable title, "Mathematics and Economics: An Interpenetration of Sciences." It was published in 1977 in VESTNIK LGU. From it one can judge the richness of the approach Leonid Vitalyevich used. There are not only results here, but also prospects.

G. Sh. Rubinshteyn. It was customary to think that mathematics was for economics, and that there was no reverse influence, but Leonid Vitalyevich interpreted the connection between these two sciences in a profound and unusual way. His views are seen by many as paradoxical. He had a similar experience with the large article entitled "Functional Analysis and Applied Mathematics," which was published in 1948 and awarded the State Prize. Then it seemed there were no two areas of mathematics more distant from one another, but Leonid Vitalyevich saw the links between them and subsequent progress in computer mathematics took this new knowledge into account.

S. S. Kutateladze. If one looks at the very first economics work of Leonid Vitalyevich, a brochure from 1939, one finds there almost no formulas, which is also true of the basic text of his book, "Economic Calculation of the Best Utilization of Resources." It seems that the author is enraptured with the possibilities that have been uncovered. Just a list of its sections shows this. It includes the distribution of the processing of parts among machine tools, the organization of production under the condition of maximum fulfillment of the plan with the given assignment, more complete utilization of mechanisms, maximum utilization of compound raw material, fuel, construction, planted areas, the best time for shipments.... Imagine: the accomplished mathematician is moving out into a quite unusual area. Not mechanics and not physics, but economics!

G. Sh. Rubinshteyn. When that brochure was published, even Leonid Vitalyevich's friends asked: "At the age of 57 is he really so burned out at mathematics that he has changed over to such frivolous work as economics?..."

S. S. Kutateladze. He was at such a level that it took years and sometimes even decades even for many of his close friends to understand. And the image of Leonid Vitalyevich in the full sense of the word does not become known quickly. One can say that he advanced record concepts. Therefore, it is not simple to evaluate him. He was underestimated by everyone, including his mathematician colleagues. What did Kantorovich do with Kantorovich? The phenomenon of Leonid Vitalyevich must apparently be regarded in its entirety. His natural gift, the environment in which this gift developed, the teacher, the personality traits....

G. Sh. Rubinshteyn. He was very lucky with teachers. He was taught by such good mathematicians and excellent people as V. I. Smirnov, whose 100th birthday will be celebrated, and G. M. Fikhtengolts.

S. S. Kutateladze. In addition to his natural gifts, his excellent teachers, the Leningrad environment and the atmosphere of creativity which reigned in the country, a large role in Leonid Vitalyevich's successes was played by his militant character, which did not fit in with his external appearance, the peculiarities of his personality or his lack of an oratorical gift.

The fact that his ideas were not accepted immediately is understandable and more or less normal. But the struggle that developed between him and certain economists was of a nature that went far beyond the clarification of the scientific truth.

G. Sh. Rubinshteyn. We can begin with the fact that the manuscript for his book, "Economic Calculation of the Best Utilization of Resources" was basically written at the beginning of the 1940's but was not published until 1959. Fourteen years had passed from the end of the war until it was published. And for a considerable proportion of this time the book was "being read" by eminent economists of those years. But still Leonid Vitalyevich's persistence enabled him to overcome the barriers.

S. S. Kutateladze. Leonid Vitalyevich was by nature a quiet, modest and delicate person, but the situations were such that he was always experiencing extreme physical and psychological pressure.

G. Sh. Rubinshteyn. Leonid Vitalyevich always worked a great deal. It would not be an exaggeration to say that he worked 16 hours a day.

S. S. Kutateladze. He went into battle and never shrank from it. In this, if you will, one can see his responsibility to his talent.

G. Sh. Rubinshteyn. L. V. Kantorovich had the courage to say what he thought. Once at an annual meeting of the academy, Leonid Vitalyevich gave a paper in which he pointed out the inevitability of a decline in the rates of development of the economy unless the conditions for management were changed. The actual decline was still quite far in the future, and this paper was received by the academic leadership with dissatisfaction.

S. S. Kutateladze. Many people know Leonid Vitalyevich as an organizer of various conferences and the initiator and leader of measures that required organizational efforts. He developed the necessary skills in himself and not without pride said that he had organized things. But what this cost him!

But it would be wrong to think that he was inherently a soft and undemanding person. This is not at all the case.

For instance, it was not at all a simple matter to obtain his signature for submitting an article to a journal. He had to be absolutely certain that the work had been done on the proper level. It was one thing to create conditions for fruitful work and to help, and it was another to submit an article for the community to judge or to submit a paper for a conference. He was even stricter, more captious and more involved with us, his co-workers and students. He would never pass on some paper that he had not really figured out or any summons. But if someone had been undeservedly bypassed or offended, or if someone had been treated unfairly, Leonid Vitalyevich would do everything he could to help.

G. Sh. Rubinshteyn. If Leonid Vitalyevich believed in someone, he gave them assignments that were much beyond what people thought they could do. Right after I had completed the University, when I was working as an engineer at the plant, he sent me an article by one respected professor which had been submitted to him by a response by Academician A. N. Kolmogorov. The article consisted of three parts although it only had enough content for one part. And I managed to point his out. Leonid Vitalyevich sent my response to

Academician A. N. Kolmogorov, and Andrey Nikolayevich asked me to publish the professor's article anyway since it had been sitting around for a long time, but I was to append to it my opinion as a reviewer, which was done.

S. S. Kutateladze. Leonid Vitalyevich created around himself an atmosphere of high inspiration. It has now become fashionable to say that it is necessary to get away from the syndrome of mediocrity, when in principle they are satisfied with average results and even build a "theoretical" base under this--saying that everyone works this way, and no large results will be achieved anyway. Leonid Vitalyevich had absolutely nothing to do with this syndrome. He himself always strove for the most complex and the most important, and he inspired everyone around him to strive for high goals. This, of course, does not mean that his students and followers did only first-class work, but there was no orientation toward mediocrity in their work.

The appearance of a scientist of this type and of this caliber is predictable in a certain historical sense. When the times require people of a particular type they appear. There are many discoveries which, as it were, are hanging in the air, as though they come forward and are actually made almost simultaneously or with a certain separation in time, but independently of one another. Among examples of this kind one can include differential calculus, and from quite modern times one can name Rubik's Cube. Types of scientists appear according to the requirements of the time. If one were to look for scientists like Leonid Vitalyevich one would have to include the American mathematician John von Newman. It is surprising how much they had in common. Like Leonid Vitalyevich, von Newman was a classical functional analyst, and like Leonid Vitalyevich he is distinguished by his unusual breadth of interests.

S. S. Kutateladze. Life has changed not slowly and smoothly, but abruptly and on a large scale. And for such a break it involved not only science--new branches of industry appeared, a very great deal changed, and the corresponding people were needed: pioneers and revolutionaries. And they were found.

A historical pattern in the development of modern society was manifested in the destiny of Leonid Vitalyevich.

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## SCIENTIST KNOWN FOR VISION AND FORESIGHT

Novosibirsk EKONOMIKA I ORGANIZATSIIA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 93-97

[Article by G. P. Akilov, candidate of physicomathematical sciences, professor at NGU (Novosibirsk): "He Fired at Unseen Targets"]

[Text] My acquaintance with L. V. Kantorovich lasted about 50 years. I am counting beginning in 1937 when I entered the mathematics and mechanics faculty at Leningrad University and Leonid Vitalyevich said that he remembered me from the Station for Young Mathematicians that was organized by LGU, where I went as a schoolboy.

Be that as it may, even a significantly shorter period of time would have been enough to see what an extraordinary person Leonid Vitalyevich was. And we students were given an idea of this even in the first semesters when Leonid Vitalyevich began to give a course in mathematical analysis.

This was done along with G. M. Fikhtengolts, whom the students correctly considered to be a brilliant lecturer. And then Leonid Vitalyevich would start to speak, stopping frequently and stammering. The students, of course, were disenchanted. But gradually, as they became accustomed to the lecturer's peculiarities, what came to the fore was what characterized L. V. Kantorovich as a mathematician, and this was interesting and instructive.

One must say that he took a very responsible attitude toward his activity as a teacher.

In his lectures L. V. Kantorovich was distinguished by dynamism and he did not go endlessly over the course that had been developed once.

He did not give as many lectures in Novosibirsk as he did in Leningrad, but he exerted a considerable influence on the organization of the work and the structure of the trading plans. At the end of the 1960's, at a meeting of the Siberian Mathematical Society, he gave a paper on restructuring mathematical education in NGU. With respect the organization of the school, the transfer of knowledge and the principal concepts, he followed--under new conditions, of course--his teacher, G. M. Fikhtengolts, who deserves a large amount of the credit for the modern arrangement of teaching of mathematical analysis at the mathematical and mechanics faculty of LGU.

I began to work directly with L. V. Kantorovich after the war, when he became my scientific adviser in graduate school. During the process of further joint work and especially on the book "Functional Analysis in Normed Spaces," which has gone through several reprintings in our country and abroad, I was able to get to know him much better, of course, than I could when I was a student.

L. V. Kantorovich's theoretical method can be characterized through his own words to the effect that a rational generalization produces more than a detailed investigation. He repeated these words so frequently that one had to think about them. He preferred the forest to the trees, it is clear, but to be limited simply to that would be a truism. Where is the boundary between the trees and the forest? It is precisely here that one finds the main thing, and the talent (or genius) of Leonid Vitalyevich was reflected in the fact that he sensed how far generalizations could go. In other words, it would be quite easy to throw the baby out with the bathwater.

"Rational generalization" enabled him to single out a relatively simple task in which the main thing in the problem was reflected as in a drop of water. He formulated the tasks of linear programming so clearly that it seemed possible to present the basic ideas of the optimal approach using only four operations of arithmetic and common sense. In the end in mathematics, everything amounts to the fundamental, basic elements, and L. V. Kantorovich emphasized this with extreme clarity in what I think is his best book--"Economic Calculation of the Best Utilization of Resources." Of course the book was written for a broad range of readers, but if Leonid Vitalyevich had not had the gift of "rational generalization" nobody knows what he would have been able to do. After all, far from every eminent scientist is a good popularizer or even a good lecturer. And this approach produced a great deal for solving complicated and difficult problems.

The difficulty of the solution is one of the widespread criteria for the mathematical mind, but in this case it does not make sense to speak about just any difficulty. Difficult problems of mathematics are distinguished from one another. I would single out three types. First, problems that are not quite correctly formulated, and then problems that in principle have no solution (for example, the continuum hypothesis), and, finally, problems whose time has not yet come.

Thus Leonid Vitalyevich successfully solved difficult problems of the third type. Let us turn again to problems of linear programming. Can one include these among the difficult ones? Now, when even students who are not mathematicians can solve them, of course, one cannot. But they became easy to solve only after L. V. Kantorovich, after the appearance of linear programming. And before him they could not be solved, even though these problems were known since the end of the 18th century, since the time of Lagrange.

Another illustration of the fruitfulness of L. V. Kantorovich's report are the results of his so-called approximation methods of higher analysis. Up until the middle of the 1940's these methods were no more than a collection of formulae. Their utilization was justified out of practical considerations,

but from the standpoint of mathematics they were either quite unsubstantiated, or clearly inadequately substantiated. This means that they did not know the upper and lower limits of the precision of the methods and it was impossible to obtain any amount of precision one wanted. In the middle of the 1940's L. V. Kantorovich began to think about what in general was happening when a problem was solved by the approximation method. By rising up over a group of individual trees (formulae) he could see their common nature (the forest) and he created a new chapter of functional analysis--the common theory of approximation methods of analysis, which was awarded the State Prize in 1949. Approximation methods of analysis since then have been transformed into a science. The old method-formulae were substantiated and each new method could now be strictly evaluated as well.

If one were to compare L. V. Kantorovich's approach to the search for a way out of a labyrinth, he made it possible to see the layout of the labyrinth. Approximately the way it is seen by children who are solving a puzzle.

Another distinguishing feature of L. V. Kantorovich's mind is his comparison of a discovery and an invention. An invention, as we have become accustomed to seeing it, is an improvement of something in a certain area. It can be intelligent, or even brilliant, as, for example, Watt's steam engine, which caused a certain enlivenment of thought and transferred ideas into different areas or changed them. But a discovery is a breakthrough into unknown areas, a theoretical clarification of a large phenomenon or even a range of phenomena during whose development there appears an immense number of ideas, including on the invention level.

"A talented person is someone who can hit better than others a target that can be seen by everyone, but a genius hits the target that nobody else can see"--this is an explanation of the difference between talent and genius. L. V. Kantorovich is undoubtedly among the latter, although he had many scientific works of the "invention" level and natural inventions of which he was clearly proud.

The destiny of inventions that are directed toward more precisely hitting a difficult target is usually fortunate. Everyone can see how a difficult thing has been done and they give the accuracy of the Bowman its due. It is another thing to hit a target that cannot be seen by everyone. For it is difficult to evaluate its importance at once. Time passes until it becomes clear how necessary it was to hit the target that was found. And then it becomes general property. The theory of relativity is now studied in school, while at the very beginning only a few people understood its author. Something similar--with all the conventionality of analogies--can be found in the creative biography of L. V. Kantorovich. Even before the war he created the concept of functional spaces which we now call Kantorovich-Banakha spaces. In defining these spaces one of the four conditions seemed artificial and unnecessary for a long time. To be sure, attempts to eliminate it did not produce any interesting generalizations. And only recently, at a very high mathematical level, in terms of the so-called Boolean-symbolic logic, which was very far removed at the time of the creation of this concept, was the essential role this condition clarified.

Having such a brilliant talent, Leonid Vitalyevich did not limit himself to mathematics. Here was the manifestation of his moral and civic qualities as a scholar in the broadest sense of the word. He himself was convinced of the immense advantage of the optimal approach for economics, and wanted to convince economists and the scholarly world of this and overcome the resistance of prejudiced opponents. It was necessary to bring the matter to completion. Here he knew no fear. (In general I do not recall a time when he was afraid, although I never saw L. V. Kantorovich in situations that were fraught with physical danger. Incidentally, from the way he conducted himself during the last weeks before his death, one can assume that he had no fear in such situations). The title corresponding member in economics, for a mathematician of world renown, certainly did not bother him; on the contrary, he saw in this a recognition of his ideas by economists.

Here one cannot but mention the purely human qualities of Leonid Vitalyevich. He was a noble person in the full sense of the word, and he was always ready to render any assistance. While undoubtedly aware of his own value, he never--neither in conversation nor in any other way--let anyone feel his superiority. He was never trivial. In joint work he extended his confidence in his co-author to the maximum degree. He was distinguished by immense tolerance of other people's opinion and he never short-changed any time or effort in explaining his viewpoint and convincing people who thought differently. His patience extended to personal relations as well. Leonid Vitalyevich was a very interesting conversationalist. His judgments and evaluations were extremely witty. His quickness and ingenuity were typical of all of his thinking.

And in conclusion, one episode from long ago. In the summer, at the beginning of the 1950's, L. V. Kantorovich and two of his former graduate students (A. N. Baluyev and I) with our wives were driving through the Caucasus. Once he and A. N. Baluyev and his wife were walking through Tbilisi and a stranger came up to them and offered to sell them a suit for 800 rubles. A. N. Baluyev and his wife went into a secluded place and made sure that the suit would fit, but they had no money with them. Leonid Vitalyevich had the necessary amount, and he was ready to lend it. But after giving the money to the salesman he changed his mind and demanded an excessive amount. The money was returned to its former owner, but when they got home they discovered that the stranger had slipped them a wad of bills that had large ones on the top and bottom only...

An argument began: Who should bear the losses? Leonid Vitalyevich considered himself to be the only one guilty, since he did not count the money (and he never did that). A. N. Baluyev and his wife, naturally, did not agree. Everything ended in a friendly manner and the losses were divided equally.

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## FRIENDSHIP WITH EMINENT SCIENTIST RECALLED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 97-101

[Article by M. I. Virchenko, candidate of economic sciences (Novosibirsk): "Beginning in the Sixth Grade"]

[Text] I became acquainted with the methods of optimization and the work of L. V. Kantorovich at the end of 1958 and the first half of 1959 when, as a graduate of the economics faculty of Leningrad University, I was preparing to receive the diploma of an economist--a teacher of political economics. At that time in our department the course in higher mathematics was taught only for statisticians, and there was nothing in the program for other specialties in mathematics disciplines. Therefore, when they began to give the course of lectures for teachers and students of the department under the title "Economic Calculations," this evoked an immense amount of interest among us and the regret that our train had already left and the work on organization of the new specialty (economic cybernetics) and the mathematization of the program of training in the department did not affect us.

This caused us to go the management and request that they leave some of the students in our course for training in mathematical methods. Leonid Vitalyevich was very flattered by this request. Because of his troubles, having received support from the rector of LGU, A. D. Aleksandrov and the leader of the commission for the new specialty, Yu. V. Linnik, in the economics department they created a fourth course for training for which 25 students remained and approximately the same number were added from Leningrad and Moscow organizations and voluntary auditors who were sent there. At that time, in the spring of 1960, L. V. Kantorovich was forming the collective of associates for work in Novosibirsk, in the Laboratory for Applied Mathematical and Statistical Methods in Economics of the Siberian Branch of the USSR Academy of Sciences. He invited several graduates of our department, and of the engineering and economics department of the Leningrad Polytechnical Institute to work there, and they were immediately assigned for training in the fourth course. After completing the training, several more people were invited to work in Novosibirsk. It is interesting to note that Leonid Vitalyevich invited to his collective young economists of various specialties: planners statisticians, political economists, agricultural economists, and engineering economists from the industrial branches. He immediately earmarked a broad range of applied tasks in economics.

Leonid Vitalyevich subsequently repeatedly noted the successful experiment in intensive training of economists in mathematical methods in the fourth course. In one school year we learned the fundamentals of higher mathematics, methods of optimization and the most interesting to us and the most important for subsequent work--the theory of optimal planning. In the second semester, when we already had a minimum of mathematical training, L. V. Kantorovich gave the course "Application of Mathematical Methods and Electronic Machines for Planning and Economic Analysis." His lectures gave us not only the author's presentation of the book "Economic Calculation of the Best Utilization of Resources," which had just come out, but immediately led us into the area of scientific discussions in which at that time radical problems of further development of economic science were being resolved. With the first of his lectures, L. V. Kantorovich began to prove and demonstrate the possibilities of utilizing mathematical methods not only in planning (at all of its levels), but also for improving the system of economic indicators, including prices and normatives of the effectiveness of resources. In the second lecture, he formulated the principle: "Indicators should be constructed in such a way that the solutions selected according to these indicators correspond to the optimal solutions from the standpoint of the national economy."

L. V. Kantorovich's book and his lectures were destined to cause a revolution in our economic thinking: economic problems, including those of a theoretical nature, acquired for us a quantitative definiteness, a clarity and a strictness. Many of his students are now participating in the realization of the ideas of L. V. Kantorovich--economists and graduates of that same fourth course. A. A. Achishkin became an academician and he is now the director of the Institute of Economics and prognostication of scientific and technical progress of the USSR Academy of Sciences; S. S. Shatalin--a corresponding member; and doctoral dissertations were defended by V. A. Kardash, I. V. Kotov, V. I. Kuzin, I. M. Syroyezhin (now deceased) and Yu. M. Shvyrkov. Working successfully in Czechoslovakia are candidates of economic sciences A. Lashchyak and Yu. Fetsanin. Leonid Vitalyevich's students of that year now have their own students, who are receiving the theory of optimal planning as classic.

In the autumn of 1960 L. V. Kantorovich, along with the group of mathematicians and economists he created in Leningrad--the ratio between them was approximately 1:1--moved to Novosibirsk. When it became clear that the Moscow group of the laboratory, headed by Academician V. S. Nemchinov, would stay in Moscow, our group beginning in 1961 became part of the Institute of Mathematics of the Siberian Branch of the USSR Academy of Sciences as a mathematics and economics division which was headed by L. V. Kantorovich until he departed for Moscow (1971).

The years of working under his leadership were distinguished by many events and a great intensiveness of scientific research and the achievement not only of scientific truths, but also of the capability of man as an individual.

Leonid Vitalyevich did not immediately begin to establish contact with enterprises and institutions of Novosibirsk. Actively enlisting primarily economists in this work, from his first steps he taught us independence and

responsibility. We studied concrete economic problems, searched for ways of representing them quantitatively, and develop the first econimico-mathematical models in our lives.

Now I should like to mention one more aspect of our work at the beginning of the 1960's. These were years of turbulent discussions, first about the very possibility of applying mathematical methods in economics and then about the framework within which this was allowable. The All-Union Scientific Conference on the application of mathematical methods in economics andd planning (4-8 April 1960) was memorable. In a heated discussion there L. V. Kantorovich defended his scientific views fundamentally and convincingly.

Especially heated were the disputes regarding the possibilities of utilizing the evaluations of the optimal plan for improving the system of economic indicators. The speakers alternated: four--against, four--against. The support for the works and ideas of L. V. Kantorovich and V. V. Novozhilov (he also gave a paper at the conference) was impressive coming, as it did, from such mathematicians as A. N. Kolmogorov, S. L. Sobolev, A. A. Dorodnitsyn, A. A. Markov, A. A. Lyapunov, L. A. Lyusternik, N. A. Shanin and B. V. Gnedenko.

When reading through L. V. Kantorovich's paper now one is impressed by his ability to embrace all basic problems of economic science in their unity and earmark ways of solving them. Especially important are the principal conclusions drawn in the paper regarding improvement of the system instructor of economic indicators for measuring expenditures and results.

Looking back over past years, one can note that improvement of econmoic indicators is proceeding, although slowly, on the whole in precisely the direction that was established in the works of L. V. Kantorovich and V. V. Novozhilov. We have introduced accounting for the capital-intensiveness in the price and payment for production capital as well as the withholding of fixed payments into the budget from enterprises that are operating under favorable conditions (transportation, natural). It has become established practice to pay for water, to account for the economic evaluation of land sections in construction, and to evaluate the results of the activity of enterprises in terms of the net (newly created) output. One must assume that in restructuring the economic mechanism, as is envisioned by the 27th CPSU Congress, the ideas of L. V. Kantorovich will be embodied even more. For truly effective expansion of independence is impossible without correctly arranged prices and other economic indicators.

The basic direction of my work under the leadership of L. V. Kantorovich is the utilization of methods of optimal planning and agriculture. And from the very beginning, in addition to the tasks of planning, we studied theoretical and methodological problems of calculating economic indicators and normatives, particularly purchase prices and rent payments for land. As early as the beginning of the 1960's we had prepared the first edition of "Economic Measures for Increasing the Effectiveness of Agricultural Production," which was repeatedly (in various variants, with additional work) submitted by L. V. Kantorovich to various planning and management agencies.

In general, Leonid Vitalyevich always considered agriculture to be a branch in which, because of its specific nature, the utilization of mathematical methods is both possible and necessary, and here they can be especially effective. He spoke at almost all the large conferences regarding the application of mathematical methods in agriculture, beginning with the first (1964). He also spoke at the XIV International Conference of Economists of Agriculture (1970) and at special conferences on price setting in agriculture conducted by the USSR State Committee for Prices. He was always interested in the condition of work on applying methods of optimization in agriculture, and was acquainted with and interested in meeting many specialists working in this area. Here it would be appropriate to note his exceptional availability, simplicity in communication, and the great deal of respect he had for the practical knowledge and the experience of specialists. This was combined with an irreconcilability to superficial judgements, mechanical interpretations and dogmatism.

Leonid Vitalyevich always kept in touch with us. Especially memorable were his "tours" after he returned from business trips. He would drop into each office, sit down with each person, go through the books on the table, and ask us what we were reading and how things were going. And then there would be a discussion of what had already been done and what still had to be done. Very frequently after such a discussion the next day Leonid Vitalyevich would bring in a sheet of paper on which he had written the points and made concrete assignments or else general ideas and directions in which we were to work. One must say that we did not manage to realize all of these points: our teacher was too generous with new ideas, having that rare ability to look far into the future.

When Leonid Vitalyevich left for Moscow we stayed in contact: he frequently came to Novosibirsk and when we were in Moscow we were certain to visit him. And everything was as it was before: a detailed discussion about what had been done, the general condition of the work on the problem, and plans for the future.

Such was my last meeting with Leonid Vitalyevich in September 1985 in Leningrad. He was interested in everything and, as always, raised concrete problems. It is painful to admit that now this is already a memory. Communication with Leonid Vitalyevich gave one sense of somehow communicating with someone great, and this was apparently created by his genius as a scientist and his grandeur as a person. And this sense remains with everyone who communicated with him, as do his ideas, his thoughts and his scientific and spiritual legacy.

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## IMPORTANCE OF PROPER WATER USE DISCUSSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 101-106

[Article by A. M. Chernyayev, candidate of geological and mineralogical sciences, Ural Scientific Research Institute of Comprehensive Utilization and Protection of Water Resources (Sverdlovsk), and Yu. P. Belichenko, candidate of technical sciences (USSR Ministry of Land Reclamation and Water Resources (Moscow): "Water: Ecology and Economics")]

[Text] Consistent improvement of the protection of the country's water resources, increased effectiveness of the operation purification structures and installations, and expansion of the utilization of purified waste waters for irrigation and other needs of the national economy were named in the Basic Directions for the Economic and Social Development of the USSR During 1986-1990 and the Period Up to the Year 2000 among the fundamental measures for the protection of nature.

How is this problem being resolved in the Urals? The peculiarity of the Ural economic region is the prevalence of industrial water consumption: up to 90 percent of all the water that is used and 85 percent of the fresh water taken from the sources are used for these purposes. Industry is concentrated in the cities, which form large agglomerations and industrial centers and regions. In order to improve the conditions for the utilization of water resources in the Urals, more than 1000 artificial ponds and water reservoirs have been created and they redistribute about 22 cubic kilometers of river water. The population and business use 8.8 cubic kilometers of natural water resources a year, of which 7.8 cubic kilometers are returned to the rivers in the form of purified wastewaters.

The diverse economic activity--plowing of land, the application of fertilizers and toxic chemicals in agriculture, the drainage of marshes, the felling of forest areas, the extraction of minerals--all this in conjunction with water management activity essentially influences the hydrological, hydrochemical and hydrobiological conditions of the rivers. Engineering methods of fighting against negative phenomena (purification of waste waters before discharging them into bodies of water, regulation of the quality of waters through dilution, clearing of the beds of rivers and so forth) do not completely solve the problem. The main reason for this is the lack of highly effective and

economically acceptable measures of purification for new kinds of wastes and the fact that construction is lagging behind in the construction of purification facilities, especially those for final purification.

The need for fresh water to dilute the wastewaters that are discharged into Ural rivers is extremely great. Therefore it is clear that the future of water management lies in the restructuring of the system of water supply and the reproduction of water in the production process itself. For water does not lose its physical properties after it is used; it is merely polluted with various impurities. One can form an artificial industrial water circulation and develop methods of repeated use or multiple recycling of water.

The overall consumption of water in the Urals has reached 43.9 cubic kilometers per year; 80 percent of this is covered through the system of water recycling and repeated use. Thus 35.1 cubic kilometers of water each year are reproduced through engineering methods.

There is now a new engineering-ecological area for water management activities. An example of this would be the water circulation systems and the systems for repeated utilization of purified wastewaters. The main shortcoming of recycled water supply is the need for regularly feeding the system with fresh water, not only because of irreversible losses, but also because of the so-called scavenging expenditure for preventing salinization of circulated water. "Scavenged," as a rule, saline waters are discharged into the rivers or into the city sewage systems. A closed water supply system is better. Here the recycled water is not only cleansed of impurities, but is also made from of salt. As a result, only solid wastes are left. Such a system is being planned for the Chelyabinsk Metallurgical Combine.

Enterprises have appeared where the water supply system is completely constructed on the principle of waste-free technology with repeated utilization of water and solid wastes. Such a system is in operation in the cold rolling shop of the Verkh-Isetskiy Metallurgical Plant (VIZ) in Sverdlovsk. Every 24 hours 400,000 cubic meters of water are returned to circulation after being purified here.

Until quite recently it was considered economically expedient to use processes and equipment which make it possible to remove from the water at best 90-95 percent of the organic and 20-40 percent of the inorganic impurities. Repurification installations at the new VIZ shop are much more effective. The treatment of a cubic meter of waste water costs 10-25 kopecks, and unpurified waste using steam equipment--about a ruble. The utilization of steam equipment instead of accumulative ponds saves 300,000 rubles a year and has made it possible to release 228 hectares of land. Deliveries of dehydrated wastes to the gypsum plant nearby provide about 50,000 rubles a year for the plant. On the whole the economic effect from the utilization of the waste-free system of water supply for the shop is 1.35 million rubles a year plus the inestimable economic and moral effect from preventing pollution of the Verkh-Isetskiy pond in the center of Sverdlovsk.

Another example. Thermal Electric power stations require immense quantities of water. The technological function of the water here is to cool the

equipment. The overall expenditure of cooling water at Southern Ural electric power stations reaches hundreds of cubic meters per second. The byproduct of the thermal electric power stations--rivers with hot water--is being utilized poorly so far. The heat is lost and the bodies of water receive heat "pollution." Is it not possible to create an ecologically closed system of water supply for thermal electric power stations?

Workers of the All-Union Scientific Research Institute of Applied Molecular Biology and Genetics of VAKhNIL, the Institute of Hydraulic Planning imeni S. N. Zhuk and the Moscow Architectural Institute have proposed a plan for an energy-biological complex using discharged heat. The industrial wastes are used by several involved businesses: hothouses, fishing, microbiological and a section of open ground that is irrigated with warm wastewaters. The technological processes are intercoordinated, which also provides for waste-free production.

Scientific and technical foundations have been developed for a waste-free system of water supply for industrial enterprises, yet extensive introduction of these is being held up by what appears to be economic considerations. Is this true? Let us try to estimate the maximum possible level of consumption of water in the Urals with efficient organization of water management.

The average daily water consumption of the population has reached 270 liters per person. Let us assume that the number of population in the Urals will remain the same. Household water consumption will increase with the increased well-being and higher standards of living to an efficient norm (the optimal would be 450 liters per day per person). With these norms the needs of the population for water will amount to about 3.2 cubic kilometers per year. The area of irrigated land could reach 14.1 million hectares. With an average seasonal norm of 3,000 cubic meters of water per hectare for irrigation, it would be necessary to have 24.3 cubic kilometers a year, and the maximum need for agricultural production would approach 44 kilometers a year.

The proportion of unrecoverable water consumption for household and domestic water supply is approximately 9 percent, and therefore the volume of waste waters will be about 2.9 cubic kilometers per year. In order to fully decontaminate waste waters of this kind, it is necessary to have approximately 10 times the amount of fresh water to dilute them, that is, 29 cubic kilometers per year.

In irrigation farming it is necessary to apply progressive methods and efficient norms of irrigation which limit the formation of recycled water. Waste water from animal husbandry and other agricultural productions will be completely salvaged, mainly in irrigation.

The expenditure of water in industry depends strongly on the production technology. In the future industrial production can change over to recycled water supply or closed and waste-free technologies.

Fresh water is reserved for those consumers who cannot do without it (the population--3.2 cubic kilometers per year, agriculture, with irrigation, 44 cubic kilometers per year, dilution of domestic waste waters--29 cubic

kilometers per year). Other natural utilized resources in an amount of 3.9 cubic kilometers per year will go to cover irretrievable losses of water in industrial production--technological processes with the organization of its expanded reproduction (we will say that they will amount to 10 percent of the quantity of industrial water).

Thus in the foreseeable future resources of water for the population, agriculture, industry and environmental purposes, with its reproduction can be increased to 115.2 cubic kilometers per year.

That is not all. If purified, domestic wastes are not discharged into the rivers but sent back into the system for industrial water supply to augment unrecoverable losses, one can release another 31.9 cubic kilometers of natural usable resources a year, which can be used for expanded reproduction of industrial water. Such a system, for example, is in operation in Krasnouralsk, where completely purified city wastewaters (4,200 cubic meters a day) are used for feeding the recycled water supply system. A plan has been drawn up for the utilization of biologically purified waste waters at the Nizhnetagil Metallurgical Plant and a number of other facilities.

The mobilization of secondary sources will make it possible to increase water resources to 402.3 cubic kilometers a year--this is about 3 times more than the average annual amount of water in Ural rivers.

The system of recycled water supply for an industrial center (Chelyabinsk) is extremely original. It is intended to include in the system the suburban lakes of Shlyugino, Pervoye and Vtoroye for hydrochemical and hydrobiological stabilization and final cleaning of preliminarily cleaned waste waters from the city. Technologies are being developed and introduced for applying purified wastes for augmenting supplies of underground water, waste-free systems of agricultural water supply using underground hydrospheres, technology for irrigating agricultural crops with waste waters, and also technology for regulating the water, air and nutritional conditions of agricultural crops on the basis of drainage and irrigation systems with efficient norms of irrigation and accumulators for drainage water. The irrigation water is saved and there is no more discharge of drainage water into the local hydrographic network, and also conditions are created for repeated utilization of these waters and the dissolved nutritive substances (circulating systems in irrigation). Waste waters are used for contour irrigation and maintaining the bed pressures in petroleum and gas deposits (Orenburg uses waste waters for 91.5 percent of its flooding) and so forth.

The conflicts of existing structures for water supply for the national economy and the protection of water resources in the Urals is valued at 7-8 billion rubles. The figure is clearly too low. But even if one uses it as a basis, water supply will cost an average of 61 rubles in capital expenditures per cubic meter of daily productivity.

The engineering-ecological solution to the problem of water supply will require several large expenditures. Therefore stage-by-stage implementation of the program will take a long time. Great expectations are associated here with the development of new methods and means, including reduction of the

proportional expenditures on the reproduction of water and the proportional expenditure of water in technological processes right down to completely eliminating it, and also increased effectiveness of the utilization of water.

The scientific and technical direction for the development of the national economy has been determined in principle: it is a changeover from extensive utilization of water to intensive utilization which relies on mobilization of internal resources and expanded reproduction of industrial water.

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## MOVEMENT FOR SOBER SOCIETY PROGRESSES

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 107-109

[Introduction to articles that follow: "Economics, Health, Discipline--And Alcohol"]

[Text] May 17, 1985, the day of the publication of the decree of the CPSU Central Committee, "On Measures for Overcoming Drunkenness and Alcoholism" has become a turning point in the society's movement toward a sober way of life. The attack on alcohol have developed a broad front. "There will be no deviations in the establishment of the norms for sobriety. We intend to resolve this problem firmly and unwaveringly"--M. S. Gorbachev said in a conversation with Tyumen citizens [Footnote 1]. A year and a half have passed. Much progress is apparent: public opinion has changed, it has become less tolerant of drunks and their protectors; labor discipline has improved; the number of highway accidents and crimes committee while drunk; the work of rural machine operators has begun to depend less on vodka and home brews; and the consumption of alcohol by women and youth has decreased. These are excellent tendenices which will have to be developed.

At the same time it has become clear that the problem is much more complicated than it seemed to certain people. Simply to "turn off the faucet in the area of trade turned out to be insufficient. In the few trade points that remained, there was a battle to buy not a bottle, but a case of wine or vodka. Sick alcoholics and their relatives frequently stop seeing physicians, since they were afraid of the heavy pressure from the community. In some places, difficulties arose with cash circulation of money. The so-called surrogate drug abuse expanded, forcing alcoholics to consume any solutions that contain alcohol and many toxic substances. The newspapers are beginning to speak at the top of their voice about drug abuse problems. "We physicians are very concerned about the fact that the number of adolescent drug abuses has increased sharply recently" [Footnote 2]. Questions of active leisure, expanded and increased demands, mass sports, family and school education and group interests began to be linked directly to the problem of alcoholism. Leonid's All-Union Voluntary Society for Fighting for Sobriety (DOBT) is persistently seeking its place in the complicated situation that has been created. In places where its neighbors have not bee separated from drunks as "clean" to "unclear, where they are organizers of interesting leisure, where

they help to establish new nonalcoholic rituals of behavior--there the influence of DOPT units is appreciable and there they are active assistances to party agencies and drug abuse services. But certain units have not been able to avoid formalism and have been too concerned about "reaching out" while others have assumed the pose of public denouncers instead of working every day with people who are drinking.

In a word, some are easing the problem while others are multiplying it. For subsequent actions it is necessary first of all to have a knowledge of the real processes that are taking place in the society and to study them without prejudice.

EKO has devoted two sets of article--in No 9 and No 10 for 1985--to the economic and social problems of the fight against alcoholism. There we analyzed the general causes of drunkenness and discussed the experience in social and medical prevention of this disease here in our country and abroad. The magazine emphasized the complexity of the problem and the need for a comprehensive and strictly scientific approach to its solution.

In the current issue we are continuing the discussion of drunkenness and alcoholism and the sober way of life. We are giving the floor to one of the active figures in the sobriety movement in the country, N. G. Zagoruyko and the medical sociologist V. V. Makarov, who has studied the dynamics of drunken behavior in recent years. They have very different approaches.

In the future, the magazine will continue to publish articles on this crucial subject.

#### FOOTNOTES

1. Gorbachev, M. S., "Sibiri--uskorennyy shag" [An Accelerated Gait to Siberia], Moscow, Politizdat, 1985, p 29.
2. "Fateful Curiosity," SOVETSKAYA ROSSIYA, 24 August 1986.

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## ALTERNATIVE TO ALCOHOLIC BEHAVIOR DISCUSSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKU) in Russian No 1, Jan 87 pp 109-118

[Article by N. G. Zagoruyko, doctor of technical sciences, professor (Novosibirsk): "But What Will We Have Instead?"]

[Text] When the great French philosopher and atheist Diderot said: "You profess atheism but what do you give man to replace religion?"--he answered: "Amazing people! I rip the bloody sacrifice from the teeth of the tiger and they ask me: 'But what do we get instead?'"

Now when our society is actively implementing the party and government decrees directed toward establishing a sober way of life, an analogous situation frequently arises: "You want people to stop drinking? But what are they to do instead?..."

And the meaning of this question differs depending on the person for whom a replacement for alcohol is being sought: for an individual person, a collective of people or the society as a whole. The overall meaning of the answer amounts to the words of Diderot presented above, but let us try to answer the question, "But what instead?", in greater detail.

Let us begin with the individual person.

The objection to complete sobriety of each individual person usually has this form: alcohol helps a person to maintain a normal psychological condition. With great overloading of the nerves and frequent stress alcohol helps to relax, to remove the tension, and to get away from troubles and unpleasantness. On the other, man needs at least from time to time to interrupt the monotonous course of daily life (even if it is quite favorable) with some kind of entertaining shakeup, and alcohol is a well-tested means of shaking things up.

The unacceptability of this assertion consists in the following: minor nervous overloading can be successfully removed without poisoning the organism with alcohol. We are well aware of the positive effect of changing the kind of activity, about which I. P. Pavlov has written a great deal. And recommendations to engage in sports, jogging or walking can, of course, be

regarded as fundamental truths, but this does not make them less true. If this is examined seriously, alcohol cannot compete with these occupations.

But if one has in mind excessive overloading or stress, here alcohol can create the illusion of a useful means, since it actually can turn off awareness of a real situation to the extent that it is possible to forget all overloading and all unpleasantness. But this is forgetting about them, and not removing their sources. Moreover, this tactic of the ostrich who sticks his head in the ground usually leads to an increase in the source of unpleasantness: instead of relaxation, which the overfatigued organism needs, it receives additional overloading and is forced to begin to continue the hard work in the condition that is weaker than before the "relaxation." And the causes of stress from drunkenness, as a rule, not only do not disappear, but increase many times over. Here drunkenness, with its manifestations in production, in daily life and in recreation, is the main generator of stress.

It is interesting that when in 1914 the "dry law" was introduced in Russia, the number of suicides decreased by a factor of 3.3 [Footnote 1].

Moreover, avoiding the causes of stress in doped unconsciousness removes the incentive to take action to eliminate these causes and thus weakens the fight for improving the society.

So even if alcohol did not generate stress, and in reality removed it, this cannot be considered an acceptable way for the individual to react to the difficulties in life.

Now about alcohol as a means of "shaking things up." The organism pays too high a price for the drunken levity, the groundless gaiety that can be observed in the initial moment of intoxication. Each gram of alcohol kills about 200 cells in the organism, many of them (nerve cells, cells in the liver and so forth) are not restored subsequently. Moreover, the intervention of alcohol in the hormonal activity causes a shift of the point of balance between those that excite and those that inhibit in the direction of the inhibiting ones. As a result, after a short period of euphoria there begins a prolonged period of depression, increased fatigue and irritability. And each time a person needs to "shake things up" more frequently and more deeply in order to feel normal.

Yet there is a way of making daily life more attractive, such as through creativity and work which deeply involves a person, requires effort and ends with a result that gives deep satisfaction. Creative exertion can be required in various areas of activity--art, science, technology, sports, public or administrative work, family pedagogy and so forth. Such a replacement of alcoholic with creative exertion is available to our society and to each individual.

Frequently when discussing this issue one hears the following: Alcohol, in addition to everything else, still fills up the free time. Where can people go who are not used to other activities: sports, creative work, books and so forth?

It is interesting that the need of the drinking person to find ways of spending his time is usually discussed by drinking workers who are involved in mental labor, who are "concerned" about those drinking workers who are involved in physical labor. Workers and kolkhoz workers, even if they are drinkers, do not ask this question. They are well aware of how much they have to do, even necessary commitments, which they put off "until later" because of drinking. It is necessary to maintain order in one's house, to help the wife (who is also a worker) to do housework, to work in the garden or orchard, and the main thing--to spend time with the children. This interesting, attractive and difficult occupational alone can absorb all the free time during the week and holidays and provide incomparable satisfaction.

The problem of healthful, creative leisure, of course, is not so simple to solve. It is necessary to construct premises for artistic activities, technical creativity and sports, and to arrange the production of materials for household diversions. But this is not limiting us now. The newspapers are always writing about rural clubs that are standing empty. Sports facilities and stadiums in Novosibirsk, for example, are occupied only 30 percent of the time. What we are lacking is an attitude of public opinion in favor of these occupations, and the main thing--enthusiasts who are qualified and active leaders and organizers of healthful leisure, especially among youth and schoolchildren.

Somehow answering the question, "But what do we have instead?", Academician T. S. Maltsev said at the All-Union Institutional Conference of the Voluntary Society for Fighting for Sobriety: "In my 80th year of life I wish that all of you could spend life as I spent it--in complete sobriety and creative work."

Now let us discuss the role of alcohol in the collective of people and the possibilities of replacing it here. To justify the use of alcohol in collective measures, they usually say the following: "Alcohol removes shyness, helps to discuss the personal side of other people, and facilitates contacts among people. Alcohol elevates the mood, and without it a party can be dull and uninteresting. Among friends, with a glass of wine, I feel relaxed, gay and carefree."

This pertains to informal meetings, celebrations and mass measures like the discotheque. But there are also considerations from the sphere of business communications: "Alcohol makes it easier to manage the collective: informal communication between the manager and his subordinates with a lower level of barriers helps to know and understand people better and gives them the opportunity to speak frankly about their suggestions and complaints. Alcohol is necessary for the business career. At the dinner table or around the campfire one can frequently hear quite serious business discussions. Someone who does not drink is automatically excluded from these discussions, where important information is learned and the basic contours of decisions are prepared.

Let us begin at the end. The edge is largely removed automatically from this aspect of the question under discussion because of the strict rules prohibiting "management" drinking bouts in their offices--whether it is with

their subordinates or with commissions "from above." The person who is submitting the work now no longer has to (must not!) provide liquor for the commission after the completion of the acceptance, and the official who comes to the establishment no longer has to relate to his subordinates in the role of a narrow pedant who drinks at his host's expense and they no longer need to go through the boring practice of drinking toasts. Business contacts are becoming considerably more businesslike. A larger proportion of the conversations between the superior and his subordinates now take place in a sober and businesslike atmosphere. There is hardly any reason to doubt that this works to the advantage both of the managers and the subordinates and, the main thing, to the advantage of the work which they are doing. When a journalist asked Academician T. S. Maltsev: "You were in charge of a business successfully for many years. How did you manage to do this?" He answered sincerely: "I was in charge of sober people!"...

The newspapers have repeatedly exposed the mechanism of drunken management. A foreman is paid for overtime work with alcohol; a worker whose drunken behavior has been covered up by the foreman subsequently will carry out any orders of his "benefactor" without complaint. We have now put a stop to this drunken level of management in the hands of people who are unable to manage normally.

Let us consider the problem of interpersonal relations, where not much can be done through administrative measures. A temporary removal of shyness with alcohol, in the first place, very frequently leads to tactless and thoughtless behavior among the people who are drinking. And, moreover, people do not learn to relax naturally in communicating with other people. People must learn this, and now an acceptable means of this communication is to conduct collective measures without alcohol--recreational evenings, birthdays and weddings. People who participate in them unanimously assert that at these functions they are much more cheerful and festive than they are when they are drunk. It turns out that in an overall atmosphere of sober cheerfulness people reveal their capacities and feel relaxed and comfortable. This does preclude the needs for measures to teach people beginning in childhood to be able to be at ease in society.

As for the cheerful, light and carefree feelings and the removal of the inferiority complex, the achievement of this condition through alcohol is essentially antisocial.

For usually the question of replacing alcohol as a source of positive emotions is raised in a purely dependent way: give us a replacement so that we do not have to do anything: we do not want to exert either our muscles or our brains, and it must be just as gay, light and pleasant. But unless one narcotic is replaced with another, there can be no such replacement and there should not be.

The positive or negative emotions that appear during communication among people are the result of the evaluation of our labor and behavior by those around us. A respectful attitude on the part of those around us is manifested as a result of good work and efforts for the benefit of the society. Whether the mood is good or bad depends on a mechanism developed during the course of

social development that regulates the behavior of the individual in the collective and the society. And to replace it with cheaply gained alcoholic cheerfulness means to destroy the system of social mechanisms and undermine social morality. Things can go as backly as one wishes and activity (or inactivity) can cause harm to the society, but a person who had purchased an alcohol drug can, at least for the time, achieve the same emotional condition which he should have earned through hard work for the Good of Society. One can say without exaggeration that these are stolen joys. There can only be one substitute here: instead of alcohol, which is an artificial means of ensuring respect" / and "cheerfulness, " / one need labor, activity for the good of people, which guarantees real respect from surrounding people and a good mood.

But the main obstacle here is the programming of our consciousness to the acceptability or even inevitability of alcohol collective rituals. The theory of "social" consumption of alcohol here too reaps the abundant fruit of its poisonous seeds. We need a radical breakdown of pro-alcoholic prejudices. Here is a large field of activity for workers in culture, means of math propaganda, pedagoges and social activities. We have a critical sense of the lack of knowledge and experiencing conducting alcohol-free collective measures. Active figures in the struggle for sobriety of the Novosibirsk Akademgorodok received hundreds of letters, and recently almost every third later contains a request to send a scenario for an alcohol-free wedding, to share experience in conducting sober anniversaries, going parties for people entering the army, and so forth. Realizing the party's slogan--"Sobriety--the norm for life?" will require overcoming an immense amount of inertia in behavior in the sphere of daily life and recreation and increasing the prestige of sobriety on the part of the individual and the collective.

Finally, about replacements for alcohol into economy and the society as a whole. The moral positions of alcohol in the society are usually justified by these considerations: "The people's need for alcohol is primary, and the production and consumption are secondary phenomena. It is necessary to fight not against alcohol, but against alcoholics," and economic positions such as these: "the low production cost and high sales prices and the rapid turnover of money make alcohol a very advantageous commodity for the economy. Otherwise where will we obtain money to pay wages," and so forth.

The first point was refuted even by the founders of Marxism. F. Engels pointed out the availability of alcohol as one of the major factors contributing to the spreading of alcoholism. And K. Marx, when analyzing the closed chain of relations between production and needs, clearly defined the main link in this chain: "Production...produces an object of consumption, and means of consumption and an attraction to consumption [Footnote 2]." There never have been and still are no fact that refute this law, so to hope that at some time the store windows will be full of attractive wine bottles and nobody will buy them is pure idealism. The refusal to drink on the part of the population and the reduction of the availability of alcohol should proceed in parallel with a mandatory, more rapid reduction of availability, that is, reduction of production and trade.

But what about the advantage and the finances? Strictly speaking, the word "advantage" in light of the goals of our socialist society is inapplicable

with respect to alcohol. Indeed, there is no advantage from the sale of alcohol either for people or for the economy. People use their money to purchase a substance which ruins their health and destroys reason and morality. To whom is this advantageous? To the people themselves or our society? The economy, having received from the population a ruble for alcohol, pays 3 rubles in economic losses. Losses are formed from the value of products that are not produced according to the principle of reduced productivity of labor and from the value of defective work, broken machine tools and machines, fires, costly accidents, Expenditures on treating alcoholics and maintaining morons and many other things.

People so not usually object to this, but they put forth this consideration: "Improvement of the economy from sibering up production is not manifested at once. And what will people use their money to purchase? Here, the following scheme is considered: profit from circulation (net income) is several times greater for alcohol than it is for other "healthful" commodities. In order to receive the same profit into the budget, it is necessary to produce 60-70 percent more of others goods than are geing produced now. It is clear that it is impossible to accomplish such an increase in such a short period of time and the only method of creating a balance between the incomes of the population and the massive commodities is to reduce the real incomes of the population or to reduce expenditure or to increase prices for goods and services. A frightening conclusion comes from these considerations: if you want complete sobriety, you comrades who do not drink very much, take from our own pocket the money which is now being spent by heavy drinkers. Even if this were actually the case, we would have to resort to this measure, for no material sacrifices are too great when it comes to saving the life and health of the people from the alcohol disaster.

But the schema presented above does not take into account the fact that sobering up has an immediate effect on the productivity of labor. Here additional commodities are made, roughly speaking, for the same wages, as a result of which, when the sales price of the commodity is maintained, the proportion of its value that goes into net income increases and becomes approximately the same as it is for alcoholic items. Healthful commodities whose production requires only materials and energy, should be increased not by 60-70 percent, but only by 15-20 percent. Academician Strumelin, at the beginning of the 1870's predicted that sobriety in the sphere of labor would increase its productivity by a minimum of 10 percent.

Since that time we have begun to drink twice as much, so the output of 15-20 percent of additional healthful commodities, as a result of sobriety in production, seems like a quite realistic task. Incidentally, at the All-Union Institutional Conference of the Voluntary Society for Fighting for Sobriety many speakers said that with a marked reduction in alcohol trade in their cities (in Tomsk, for example, it was 56 percent) trade is successfully fulfilling plans for commodity turnover. These figures were given for one of the cities. During the 3 months when the anti-alcohol decrees have been in effect, trade in alcohol has dropped by 40 million rubles, but during this same time more than 50 million rubles' worth of healthful commodities, will produce as a result of increased labor productvity. At the same time crime decreased by 18 percent and death from injury involving alcohol decreased by

30 percent. Of course, production and trade had to manifest both energy and inventiveness. One gets the impression that the inability or lack of desire to work in the new way is the real reason for the protection of alcohol in the economy.

There are neither moral nor economic justifications for keeping alcohol in a socialist society.

The restructuring of the financial and economic mechanisms for completely alcohol-free work will require large efforts and will affect the activity of millions of people. As the experience in the first year of implementing the party decisions concerning this restructuring shows, the major difficulty here too is the inertia in the thinking and behavior of the people. It is not enough to recognize that there are no such things as harmless doses and kinds of alcoholic items. The inevitability and immediate need to rid the society of alcohol must be recognized to such an extent that each person, including those employed directly in the production and sale of alcohol, becomes an active participant in the sobering up of our economy.

And so regardless of which aspect of the question "But what do we have instead?" one considers, there is only one conclusion: instead of what we are losing and destroying because of alcohol we have our own health and the health of our children, a happy family, creative labor, a friendly collective, an effective economy and a powerful, flourishing state.

#### FOOTNOTES

1. KOMSOMOLSKAYA PRAVDA, 16 April 1985.
2. Marx, K. and Engels, F., "Soch." [Works], 2nd ed., Vol 46, part 1, p 29.
3. EKO, No 4, 1974, p 36.

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## YOUTH ALCOHOL PROBLEMS INVESTIGATED

Novosibirsk EKONOMIKA I ORGANIZATSIIA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 118-143

[Article by V. V. Makarov, candidate of medical sciences (Novosibirsk): "Alcohol and Youth: To Know in Order To Act"]

[Text] The measures that are being implemented today for overcoming drunkenness and alcoholism are directed toward the entire society. It seems promising to search out the age groups that are most sensitive to alcoholic influences. Attention is especially drawn to the age of adolescence and youth. It is characterized by a receptivity to everything new and high authority of contemporaries and comrades who are somewhat older, the so-called youth substructure which is most clearly manifested in the sphere of free time. At this age there are repeated changes in collectives, groups of communication and social roles. The senior classmen change their role by transferring to junior courses in special educational institutions, youth are drafted into the service, and sometimes from "former" discharged servicemen they again fall into junior roles in production or in educational institutions. They have not managed to adapt to this role before they again have to begin much all over again: they are concerned about families. This is a very strained and responsible period.

The segment of life from 14 to 25-27 years of age is a zone of greatest sensitivity to alcohol influences. Therefore in the struggle for a sober way of life for all the population, the group of youth-adolescent and young age seems to be especially important. It is here that one can most easily break the succession of alcoholic traditions and turn firmly in the direction of a sober way of life for the entire society.

### The Degree of Involvement in Drunkenness

Our experience in anti-alcohol work with youth has enabled us to single out seven levels of involvement in the consumption of alcoholic beverages.

The zero level are sober people who are unfamiliar with alcoholic beverages. Alcohol is not used because of family traditions or the person's individual will to remain completely sober.

The first level is the initial one. It is characterized by single or very rare occasions of consumption of alcohol beverages. Bouts of drinking are accompanied by a complex of unfavorable aspects, from the smell, taste and intoxication. Alcoholic euphoria does not develop.

The second level is episodic consumption of alcohol. Small doses of alcohol can already be tolerated well and, what is especially important, they cause euphoria. It is the elevated mood that makes alcohol attractive. The attitude toward alcoholic beverages is mostly frequently ambivalent. People rarely initiate drinking bouts themselves.

At the first two levels of consumption of alcohol measures of a prohibitive and educational nature usually lead to a reduction or a curtailment of the consumption of alcoholic beverages.

At the third level there is a high risk of development of alcoholism. Alcohol produces considerably more pleasant sensations than unpleasant. The number of occasions for drinking increases and the frequency of alcoholic excesses usually exceeds two a month. Small doses of alcoholic beverages may be taken in the morning in order to improve one's condition. New fraternal relations are established with people who drink. As a result of drunkenness there are episodic conflicts with various social institutions.

Individuals at the third level of involvement in the consumption of alcohol are in need of measures of social control that limit drunkenness. Explaining to them the danger of the extremely imminent development of alcoholism as a disease and measures for reeducation can lead to a curtailment of drunkenness.

The fourth level is psychological dependency on alcohol. These people are usually active initiators of drinking bouts and their frequency increases to several a week. The desire for alcohol is noted not only during the evening, but also throughout the course of the day. Drunkenness becomes the desired psychological condition and the euphoria from alcohol is clear-cut and prolonged. Modes of behavior change. Contacts with previous friends are broken. Typically, conflicts with social institutions related to drunkenness become more frequent.

At the fourth level of involvement in the consumption of alcohol the patients have an expressed resistance to limitations on their drinking. They already have a formed system of self-protection which enables them to stubbornly fail to notice the actual problems caused by the consumption of alcohol.

Measures of a prohibitive and reeducational nature must be continuous. Measures of medical influence are increasingly significant.

The fifth level is physical dependency on alcohol. The psychological dependency becomes worse. There is increased tolerance of alcohol. Disturbances of the memory during periods of intoxication increase. The need for intoxication develops. The consumption of small doses of alcoholic beverages leads to an unconquerable desire to drink more and more and ends up with severe intoxication.

At the fifth level the patients either exert resistance to any measures for restricting their drinking or they look for help and try to escape their fatal addiction. They need extended therapy and constant supervision. Regular measures of a prohibitive or reeducational nature are necessary to maintain the condition of abstinence. At this level there is a dissociation and personality changes become marked. But still the majority of the population are very unsure and do not always regard this condition as the disease of alcoholism.

The sixth level is alcoholic disintegration of the personality. Binges develop, when alcohol is consumed for several days in a row from morning until evening, and then there are several days of intermission. The previous euphoria from alcoholic beverages no longer appears. Changed forms of drunkenness are typical: with reduced spirits, hostility, fear and hallucinations. Diseases of the internal organs of an alcoholic nature are typical. Changes in the personality increase and alcoholic feeble-mindedness gradually develops.

In this stage the patients periodically look for help and resort to treatment, but frequently they interrupt it and go back to drinking. They need constant measures of a therapeutic, prohibitive and reeducational nature. Changes in the personality are sharply marked, and only in this final stage do people around them clearly regard the drunkenness as a disease.

In the system presented here, there are three principally distinct groups: sober people; those who drink without manifestations of dependency; and people who are ill with alcoholism. This approach makes it possible to include the entire population in the observation.

Is the probability of drunkenness becoming a disease very great? According to observations conducted in the Ukraine, 25-40 percent of the people who drink regularly from the age of 16-18, by the time of the investigation at age 20-30 had not developed indications of illness [Footnote 1]. In rarer cases alcoholism in adolescents develops so rapidly that even at the level of initial adaptation to alcoholic beverages, during the first alcoholic excesses in life there are symptoms of physical dependency on alcoholism. These patients comprised 7 percent in our observations [Footnote 2].

#### How To Reveal the Degree of Involvement in the Consumption of Alcoholic Beverages Among Young Workers

Two investigations: of students of one GPTU, where only boys were studying, and also young workers of both sexes, showed the following distribution among the various levels of involvement in consumption of alcohol (Table 1).

From the data from the investigation of students in the GPTU it became clear that 8 percent needed anti-alcohol treatment and another 21 percent needed immediate measures of a preventive nature.

The picture of the alcoholic situation of young workers was somewhat different. Here the majority of teetotalers were girls. Of those observed, 10 percent were in need of anti-alcohol treatment and another 18 percent were

in need of immediate measures of a preventive nature. In the majority of cases, minors had begun to consume alcohol even before they had begun to work: up to 15 years of age--32 percent, and 15-16 years--another 33 percent of those who were observed.

Table 1

Level of Involvement, % of Total	GPTU Students	Young Workers
0-Nondrinkers	10	22
1-Initial	24	26
2-Episodic consumption of alcohol	37	24
3-High risk of development of alcoholism	21	18
4-Psychological dependency on alcohol	4	8
5-Physical dependency on alcohol	4	2
6-Alcoholic disintegration of personality	0	0

Measures of a therapeutic and preventive nature among young workers can be more successful than among workers from other contingents of minors. When they are at the center of attention of the labor collective, this makes it possible to transfer some of the functions of the usually unfavorable family to the collective. Unfortunately, increased attention from the administration and public organizations is usually focused mainly on minor workers, and after they reach 18 years of age attention and supervision of them weaken.

Let us give the figures from a repeat investigation in 1985 of 102 minor men and women workers of one industrial enterprise whom we had observed 2 years earlier (Table 2).

Table 2

Nature of Employment or Location During Period of Investigation	Men	Women
Continue to work. No alcohol problems	32	27
Transferred to another industrial enterprise.		
No alcohol problems	15	32
On active duty in the Soviet Army	20	--
On regular statutory leave	--	16
Continue to work. Are absent and drink	4	--
Have been discharged, housewives	--	13
Have transferred to another industrial enterprise. Drink and are absent	6	--
Have been fired for improper performance of duties	3	9
Have committed legal violations	19	3
Have been transferred to disability	1	--

Only a small proportion of the young workers with alcohol problems continue to work in their previous job after reaching adulthood. Attention is drawn to the rare cases of firing because of being drunk. Among those who continue to work at the same enterprises, a considerable majority do not have problems associated with the consumption of alcohol beverages.

The picture was different when we investigated young female workers after they had reached adulthood. More than half of them had changed jobs or become housewives. It was typical of this contingent to be married early and give birth to children. Public opinion is less tolerant of drunkenness among young women and therefore more of them than men were fired on the initiative of the administration. Some of them who were investigated got married, frequently to drunken husbands, and they have children with a high probability of pathological deviations.

An important task is to single out from the mass of young workers and PTU students individuals with high levels of involvement in the consumption of alcohol, who not only drink heavily themselves, but also spread drinking traditions among their contemporaries. One of the ways of revealing them is an investigation using screening questionnaires.

Screening is a method of investigation that provides for obtaining information rapidly. It does not presuppose the establishment of a diagnosis, but it makes it possible to single out the contingent with alcohol problems. Working with screening questionnaires is generally available. When developing the questionnaire, some of the questions are taken from the Michigan Test for screening for alcoholism, adapted for adults at the Faculty of Psychiatry and Medical Psychology of the Novosibirsk Medical Institute.

We suggest that the EKO readers become familiar with the screening questionnaire as an instrument for discovering young people who are in need of anti-alcohol assistance (see the next page).

The subjects themselves fill out the questionnaire, underlining one of the answers to each question. When they do not have the necessary number of blank forms, another procedure is used. The person being questioned is given a blank sheet of paper and then the questions are read aloud, and he writes down the number of the question and his answer next to the number. Then the person conducting the investigation writes down the value in points next to each answer. The sum of points is the result of the investigation. Screening is used successfully both in mass and in individual investigations. The time spent on filling out and processing the questionnaires is 5-7 minutes.

The values of the points, depending on the level of involvement in drunkenness, for boys are: levels 0-2--0 to 20 points; and third and fourth levels of involvement--28-58 points.

Boys with more than 20 points need added attention. They can be sent to a drug abuse counselor for advice. Those with over 30 points should be sent first.

The values of the points depending on the level of involvement in drunkenness for girls are: levels 0-2--0-15 points; and the third and fourth levels of involvement--16-78 points.

Girls who have more than 15 points require increased attention and consultation with a drug abuse counselor. The first to be sent to the drug abuse counselor should be those with more than 35 points on the questionnaire.

Please Underline the Answers That Are Correct for You.

- |   |    |     |
|---|----|-----|
| 1. When you consumed alcohol for the first time in your life,<br>did it leave you with pleasant recollections?          | No | Yes |
| 2. Is alcohol a way of taking up your free time?  | No | Yes |
| 3. Do your friends drink more often than twice a month?   | No | Yes |
| 4. Do discussions of drinking make you want to drink?   | No | Yes |
| 5. Has it ever occurred to you that you need to reduce<br>your consumption of alcohol?                                  | No | Yes |
| 6. Have you ever had a feeling of guilt or disturbance<br>because of your consumption of alcohol?                       | No | Yes |
| 7. Do some of your acquaintances think that you drink<br>too much?  | No | Yes |
| 8. Do your parents or relatives think that you drink<br>too much?   | No | Yes |
| 9. Could you spend an entire holiday or birthday without<br>drinking at all?  | No | Yes |
| 10. Is it difficult for you to refrain from drinking<br>alcohol?  | No | Yes |
| 11. Have you ever had difficulties in school or at work<br>because of the consumption of alcohol?                       | No | Yes |
| 12. Have you ever been arrested by patrols or the police<br>in a drunken condition?                                     | No | Yes |
| 13. Have you ever forgotten the preceding evening after<br>drinking?  | No | Yes |
| 14. Have you ever had occasion to drink in the morning<br>or on an empty stomach in order to improve your<br>condition? | No | Yes |

Surname (not mandatory)

Year of Birth

Sex

Thank you!

The reliability of the information that is obtained is fairly high: for levels 0-2--in 98 out of 100 cases the questionnaire produces the correct results, and in the other two cases it raises them. For the second group (level 3-4) the result might be lowered in 16 out of 100 cases, when the questionnaire does not reveal people with alcohol problems.

In order to maintain the working qualities of the questionnaire, adolescents should not be informed of the principles of working with it. It is best when the investigation is conducted by a specialist from whom they expect neither judgment nor punishment. The screening questionnaire can be used among other questionnaires that pertain to the working conditions, wages, nature of free time and diversions.

#### Level of Knowledge Regarding Questions of Drunkenness and Alcoholism

For effective anti-alcohol measures and for publicizing a healthful, sober way of life, it is necessary to determine the level of knowledge and the correctness of the ideas regarding questions of drunkenness and alcoholism in those contingents for whom these measures are intended, and also specialists who are implementing the anti-alcohol program.

We investigated the level of knowledge and the correctness of ideas about drunkenness and alcoholism using a specially developed questionnaire and the interview method.

We consider the standard to be the level of knowledge of physicians which is equal to 1.0. The level of knowledge of PTU students and young workers is equal to 0.68. This corresponds to the average indicator obtained as a result of examining 3,000 students, workers and employees.

Unexpected results were produced by the examination of pedagogical collectives of PTU's. The level of information of instructors turned out to be equal to 0.57. The students were more informed than their teachers regarding questions of drunkenness and alcoholism. Therefore the effectiveness of anti-alcohol work conducted in these schools elicits justified mistrust.

The level of knowledge and the correctness of ideas about drunkenness and alcoholism were investigated in two groups of engineering and technical personnel at different enterprises of the same ministry. In the investigation of 1984 the level of knowledge of engineers was equal to the overall average indicator. The investigation of 1986 showed a considerable increase in the level of knowledge and correctness of ideas concerning problems of drunkenness. Here one could unquestionably see the effect of the large amount of work that has been done in the country since the publication of the well-known decree concerning measures for overcoming drunkenness and alcoholism. The level of information of engineering and technical personnel turned out to be higher than for the majority of those who were examined: workers, instructors and students. As distinct from the first investigation, when the engineers considered the fight against alcoholism a medical problem, in the second one they considered overcoming drunkenness and alcoholism to be their own problem.

Table 3

## Values of Responses in Points for Boys

Number of question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Responses in points:														
No	0	0	0	0	0	0	0	0	5	0	0	0	0	0
Yes	2	3	6	7	1	0	3	5	0	6	2	10	1	7

## Values of Responses in Points for Girls

Number of question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Responses in points:														
No	0	0	0	0	0	0	0	0	8	0	0	0	0	0
Yes	5	5	7	1	2	8	5	8	0	5	10	5	4	5

## A New Tendency--Reducing the Consumption of Alcohol by Youth

The first half of the 1980's was characterized by increased consumption of alcoholic beverages by youth. Boys drank more but the rates of increase in their consumption of alcohol were lower. Girls drank less, but the rates of increase were higher for them. There was a dangerous tendency toward equalization of the consumption of alcohol among boys and girls.

At the beginning of 1985 we conducted an extensive investigation of various contingents of youth in Novosibirsk which included 3,700 individuals. At the end of 1985 under conditions of the widespread fight to eliminate drunkenness and alcoholism, we did another selective investigation of this same contingent of youth.

In training institutions where the fight for sobriety was waged perfunctorily and unskillfully, the prohibitive and punitive measures sharply outstripped the anti-alcohol propaganda. And here is the result: girl students in the senior course of the teknikum, when the screening questionnaire was filled out in February 1985, in 87 percent of the cases thought that one could happily spend a holiday or a birthday without drinking, and only 13 percent thought that it was necessary to drink. In December of that same year 80 percent of these female students stated that one could not do without drinking, 2 percent said that it was possible, and 18 percent did not give an answer at all. The prohibitive measures, without in-depth explanatory work, only incite interest in the "forbidden fruit." Among adolescents with asocial behavior during 1985, essential changes were discovered only in the frequency of the consumption of alcoholic beverages. During the second half of the year the frequency of the use of alcohol decreased, and the amounts consumed began to fluctuate sharply, which is explained by the reduced availability of alcoholic beverages, particularly the prohibition of sale to individuals who had not reached the age of 21. It should be emphasized that such a restriction will be effective only under conditions of constant supervision. Thus according to foreign data [Footnote 3], the introduction in 1979 in one

of the United States of a law to raise the minimum drinking age from 18 to 20 produced an effect only in the first year. According to data from annual telephone questionnaires of 1,000 people and an analysis of traffic accidents, the influence of this legislation was generally insignificant. And in more than 30 percent of the cases of drinking the 16- and 17-year-old adolescents themselves were able to acquire the alcohol, and the sales clerks were simply not interested in their age.

Naturally, the conditions of a socialist society provide greater possibilities of supervising the dissemination of alcoholic beverages.

Among the contingents of youth we investigated in 1986, highly reliable information was obtained from students in senior classes. The investigation of students using questionnaires has been conducted continuously since 1983. The people questioned filled them out anonymously, under individual pseudonyms. Subsequently each student is notified of the level of his involvement in the consumption of alcohol and the degree of risk of the development of alcoholism. Such anonymous consultation increases the reliability of the filling out of the questionnaires and the level of sincerity in the responses. Only those who wish to are asked to fill out the questionnaires. As a rule, they all do.

Let us compare the results of the investigations of boys and girls aged 21-23 conducted consistently in November-December 1984, November-December 1985 and April-May 1986.

Table 4

	Years of Investigation		
	1984	1985	1986
Did not drink	2	8	7
Once a year	14	12	18
Once every 3 months	24	36	38
Once a month	34	24	23
Several times a month	18	10	9
Once a week	0	0	2
Other responses	8	10	3
	100	100	100

The girls respond. The frequency of the consumption of alcohol by female students in the senior classes of VUZes (Table 4).

As one can see from the table, there was a reduction of the frequency of the consumption of alcohol at the end of 1985 and this effect held during 1986. There was a reduction of the doses of alcoholic beverages that were consumed. It is important that there was an increase in the number of individuals who completely abstained from alcohol.

From the broad spectrum of occasions for consumption of alcohol, three are most important (Table 5).

Table 5

<u>Occasions for Consumption of Alcohol</u>	Years of Investigation		
	1984	1985	1986
Holidays	43	45	45
Family celebrations	29	26	19
Meetings with friends	25	16	19
Other responses (other occasions)	3	13	17
	<u>100</u>	<u>100</u>	<u>100</u>

Attention is drawn to the fact that holidays are persistently the most frequent occasions for the consumption of alcoholic beverages. At the same time, the role of family celebrations and meetings with friends is decreasing.

For a more complete understanding of the attitude of a young boy or girl toward alcohol, it is necessary to have information about the consumption of alcoholic beverages by their friends (Table 6).

Table 6--Frequency of Consumption of Alcohol by Friends

	Years of Investigation		
	1984	1985	1986
Do not drink	3	3	7
Drink only on holidays	59	80	79
Drink several times a month	28	10	6
Drink several times a week	2	2	2
Other responses	8	7	6

The number of people abstaining from alcoholic beverages increased in 1986. The number leading a sober way of life among those investigated and their friends were almost equal. This corresponds to data showing that young people who do not drink spend their free time and holidays together. Friendly relations subsequently develop among them. There is a stable tendency toward reduction of the number of people who drink several times a month. Some of them began to resort to alcohol only on holidays, which led to an increase in the number of people consuming alcohol only on holidays.

Data concerning the attitude of close friends toward alcoholic beverages are important (Table 7).

Table 7--Attitude of Loved Ones and Friends Toward Alcohol

<u>Types of Attitudes</u>	Years of Investigation		
	1984	1985	1986
Negative	16	19	21
Neutral	43	45	54
Positive	27	16	16
Other responses	14	20	9

Our questionnaire does not make it possible to determine an equivocal attitude toward the consumption of alcoholic beverages. That is why there were so many answers in the last column. One can note a stable tendency toward increase in the negative and neutral attitude toward the consumption of alcohol.

Thus in the second of 1985 there was a reduction of the frequency of the consumption of alcohol both by the VUZ students, who were investigated, and by their friends. Family celebrations and meetings with friends began to figure less frequently as occasions for drinking. There was a larger number of people who abstained from alcohol completely. The frequency of a positive attitude toward alcohol on the part of friends decreased, while the negative and neutral attitudes increased. The positive result of 1985 held true in 1986 as well.

A different picture was revealed for boy students. The reduction of the frequency of consumption of alcohol noted at the end of 1985 changed to an increase in 1986, although, to be sure, it did not reach the level of the end of 1984. The number of people who completely refrained from alcohol were: in 1984--1 percent, 1985--2 percent and 1986--6 percent of those investigated. The basic occasions for the consumption of alcohol--were holidays, meetings with friends and family celebrations--remain the same, but the role of meetings with friends as an occasion for drinking decreased in 1985 and returned to the initial level in 1986. The attitudes of parents toward the consumption of alcohol during the period under consideration changed insignificantly. The attitude toward alcohol on the part of close friends did not change either, but the frequency of their consumption of alcohol beverages decreased somewhat. There was an increased number of friends who completely refrained from alcohol. In 1984 they amounted to 3 percent, and in 1985 and 1986--7 percent. The tendency noted in the second half of 1985 toward a reduction of the consumption of alcoholic beverages by boy students did not remain in 1986. One can speak confidently only about a reduction of the growth of consumption of alcohol among senior class students.

Attention is drawn to the change in the nature of the discussions of the availability of alcoholic beverages. In past years, opponents of the consumption of alcohol had to defend themselves, justify their position of abstinence and look for real reasons for refraining from alcohol. Proponents of its consumption felt confident.

In today's discussions proponents of drinking are clearly losing. They are defending themselves and trying to give more and more arguments in favor of the admissibility of moderate consumption of alcohol and the need to observe traditions. Such open discussions in youth collectives are especially useful. They contribute to the development of norms of living without alcohol.

Thus according to data from an investigation of students in senior classes of VUZes, the tendency over many years toward increased consumption of alcoholic beverages among youth changed in the second half of 1985 to the opposite. The process of reduction remains stable among girls. And the situation with the boys can be regarded more correctly as a lack of increase. There was a gratification of youth: in one belt were those who abstained completely from

alcoholic beverages, and in the other--those who continue to drink frequently. So far there are twice as many of the latter.

Measures for fighting against drunkenness are producing results. It is wonderful that a strong field of attraction has formed around youth who lead a healthy, sober way of life. One must not forget that people who drink are frequently at the other extreme. In between is the majority, comprising almost three-fourths of the youth. They must define themselves, recognize their sympathies, and join one of the two extremes. Under the conditions of public censure of the consumption of alcohol, there has already been a disturbance of the subjectively pleasant effect from small doses of alcohol. One can predict that this will lead to a further increase in the number of people who abstain from alcohol. But this will not take place of its own accord.

Those who prefer sobriety today must attract people through their activity, filling their life with interesting events, and achieving the goals that are set. It is especially important to organize free time, including celebrations and holidays. For holidays are still the main occasions for drinking. Hence--the conclusion: one of the main ways of fighting for sober youth is to organize free time in such a way that it would be uncomfortable and unpleasant to drink, and cheerful and interesting to stay sober.

#### Free Time--Without Alcoholics!

In recent decades the conditions under which youth grow up have changed. The process of acceleration, having accelerated physical development, has led to early biological maturation. Prolongation of the period of study has brought about late social maturity and independence. The concentration of the population in the cities has led to relieving children, adolescents and youth of many kinds of work that are traditional for the rural way of life, which has significantly expanded the sphere of free time.

It is impossible to imagine youth without diversions, friendship and a desire to communicate with their contemporaries. A study of youth has shown that similar diversions are typical for various groups and the differences pertain more to the frequency of various forms of spending leisure time. These include watching television or movies; visiting with contemporaries; sports; modern music concerts; reading; technical equipment (most frequently motor vehicles and radio equipment); and raising animals. The list is given in the order of popularity of the various kinds of leisure among PTU students and young workers. Attention is drawn to a fact that seems paradoxical at first glance--that youth with alcohol problems have even more diversions than do their contemporaries who are healthier. Young people who drink spend more time with friends and visit places of organized recreation more frequently. They share diversions that are popular in their environment. To be sure, their involvement is extremely superficial, and their level of knowledge usually enable them only to hold idle conversations. And from the broad spectrum of diversions they choose only those that do not stand in the way of their drinking. The conclusion: The fact of the existence of diversions in and of itself, even a large number of them, is still not a way of distracting people from drunkenness. The idea that adolescents involved with alcohol

spend their free time somewhere alone, concealed from the eyes of those around them, does not correspond to reality either.

In the opinion of psychologists, adolescents have an almost instinctive attraction to solidarity and grouping with their contemporaries. Adolescent groups can be found throughout the entire history of mankind, from the primitive society and ancient Sparta to the modern hippies [Footnote 4].

Spending time in groups, the so-called street youth, is the least organized and supervised aspect of the life of youth. Here one can see the imperfections of educational institutions and shortcomings of the family educational influence, which are brought about by increased employment of parents, and in some cases their inability to provide real education and their low cultural level.

Young people with positive social circumstances are well-organized in the sphere of production (training) and poorly in the sphere of conducting free time. The so-called "difficult" adolescents, who show no interest in either training or work, join into groups to spend their free time, of which they have a surplus. These groups can occupy a dominant position, advocating manifestations of the anticulture: drunkenness, smoking, aggressiveness, the cult of things. Strong people always find supporters, and a certain proportion of youth with characteristics of increased impressionability and psychological instability join such groups, thus considerably expanding their numbers. This is why it is so important to create in the sphere of free time collectives of youth who advocate a healthy way of life.

Until quite recently, leisure was considered something secondary in a person's life. Rather, its importance was admitted in words, but it was not experienced in real deeds. At the present time the situation is changing radically. The importance of improving the organization of free time is being recognized as a necessary factor in the social development of the society and one of the basic conditions for the success of the struggle for a healthy, sober way of life. The decree of the CPSU Central Committee, "On Measures for Overcoming Drunkenness and Alcoholism," draws attention to the need to improve the sphere of conducting free time. And the decree of the CPSU Central Committee, "On Measures for Improving the Utilization of Club Institutions and Sports Facilities" [Footnote 5] points out the significance of organizing leisure in eradicating drunkenness and alcoholism.

We will not set the task of analyzing all forms of organization of free time. We shall limit ourselves to clubs and independent youth associations for various interests. These are very different forms in the sphere of free time. They can be divided into two kinds: those that exist only for members of a given club, and those that are intended for work with a broad audience. Let us consider the latter, since they are the ones who are capable of exerting an influence on a broad range of youth.

The questionnaires we conducted among youth show that the most popular forms of spending leisure time on Sundays and free evenings are visiting youth cafes, cafe-clubs and discotheques. On Sundays and free evenings, as we know, alcoholic beverages are consumed most frequently. An analysis of the work of

youth cafes in past decades showed that at the beginning of their creation they attracted visitors with interesting programs and only a few of them--with the good work in the kitchen. Having become popular, the cafes changed rapidly. Soon the only people who could go there were those with the ability to spend a significant amount of money. These institutions remained popular for a certain amount of time. This is where it was possible to meet young boys and girls who drank only because they had come to an interesting program and without ordering alcohol they could not get a place at a table. But after a year or two these young people began to come to the cafe in order to drink. The program no longer interested them.

There were also initiatives on the part of youth to transform the cafe-clubs into nonalcoholic ones. These attempts initially received a hostile reception by the administration and service personnel of the cafes. But soon the service personnel found a "solution": they were given the opportunity to sell alcoholic beverages with impunity by masking them as nonalcoholic ones, to set the prices arbitrarily and to decide to whom and in what quantities the alcohol could be given, and they were even given the right to expel drunks from the "nonalcoholic" cafe.... A similar picture could be observed at youth discotheques. An investigation we conducted at the beginning of the 1980's of organizers of discotheques in Novosibirsk showed that they had a positive attitude toward the consumption of alcoholic beverages at youth parties (95 percent). True, there were stipulations: alcohol in small qualities, only good wines and only dry wines. And only 5 percent of those questioned expressed a clearly negative attitude toward alcohol at discotheques. Similar data were obtained by investigating organizers of discotheques in the Ukraine. The investigation of organizers of discotheques in Uzbekistan produced different results. There 70 percent were against alcohol at youth parties, 20 percent were for it, and 10 percent of those questioned did not have a particular opinion.

Before the introduction of the well-known decrees concerning the elimination of drunkenness and alcoholism, in many youth cafes and discotheques there was a situation in which alcohol was the main and frequently the only means of organizing a good time. Subsequently cafe workers, music groups and discotheques showed their helplessness in organizing active recreation of youth without alcohol. Positive experience in this area is found only in single cases, although the central press has written about this fairly completely and interestingly.

Now let us return to the 1970's. Let us consider the five-year path and the experience of conducting youth parties in cafes of the widely known Novosibirsk Association Terpsichore.

Before entering the cafe you are greeted by clowns. They provoke you and egg you on. A person who has come to the party for the first time could be somewhat offended. But everything is explained in the foyer. Everyone who comes in is given a number of offers: Would you like to be a clown--here is a costume; we need people who can count quickly; we need experts in easel painting; we need people who can dance the polka....

In the hall groups of youth discuss what they can offer for general viewing today and how to participate in the competitions and improvisations. And everywhere they invite you to join in and participate. Incidentally, nobody is forced; one can simply sit and watch. And as soon as you want to you can become an active participant; there are enough activities for everyone.

The person in charge of the evening appears and the program begins. It includes information about various areas of culture and art, the latest local news, presentations of folk and ballroom dances, multifilms, competitions and improvisations involving all participants at the party. All this alternates with dancing. True, the sound equipment is clearly imperfect. It breaks and is fixed many times during the course of the evening. The repair is done in front of those in attendance and with the help of radio amateurs among the guests of the club. Their success is rewarded with the same applause as the performances of the dancers.

The person in charge of the party corresponds surprisingly to the description in the book "Technique of Discotheque" (Footnote 6). He is usually an intelligent and active conversationalist, a conversationalist-leader who has the talent of direct communication. He is the "heart of the company," a kind of "first man in the village" (let us note that it is the "academic village" of the age of the scientific and technical revolution). This "live wire" of the discotheque is to be in charge of the festive atmosphere and have something to share during the course of communication with participants in the discotheque. Moreover, he proposes a sober way of life, knows both classical and popular music, and wants to find in each person talents that enable him to be interesting to everyone. At these parties all people present are active and reveal themselves freely, everyone is gay and interesting. The very arrangement of the parties has created a holiday atmosphere.

Subsequently in Terpsichore there appeared another leader, a fan and admirer of modern popular music. At first he only made the musical selections for the dances, and then he began to prepare information programs concerning modern art. Soon these parties began to be called by a new word--discotheque.

The second leader now began to prepare and conduct all the parties. The discotheques in the cafes of the Komsomol raykom became very popular. Through the efforts of the second leader the equipment improved rapidly, one could hear more and more fashionable innovations of modern popular music, and complete cost accounting was introduced. The parties began to be conducted considerably more frequently. Their structure changed as well. Now at the beginning there was a thematic program with a discussion of groups, records, performers, and then there was the dance program and the bar.

The usual composition of the visitors to the parties changed by approximately one-third. There were more fans of modern popular music. There was a "mass inactivity" among participants in the parties. During the first part of the discotheque they were told to sit passively at the table and look and listen, and in the second part they were to dance. Almost all of them liked the modern popular art, but only a few were interested in the details of the lights of the stars. At the beginning of the dances the people felt unprepared, that they had not loosened up. The leader of the discotheque

provided an example of solving this problem. He loosened up with...alcoholic beverages. Alcohol was a part of these evenings in the cafes before as well, moreover, an important concern of those who arrange these evenings was to maintain its consumption at the proper level. It was prestigious to be sober. Now it became popular by the beginning of the dancing to have many bottles on the table.

The majority of the visitors did not like the new type of parties. After many requests, they returned the first leader. It seemed that everything would be as it was before or even better. But it seemed that way only in the beginning.

Popular music fans were clearly bored by programs devoted to classical ballet or folk dancing. They did not leave, but they began to drink even more.

The drunken ones could not participate in the complicated programs that require intellectual effort and coordination of movements.

And here was the regular party. On the stage was the first leader. He called upon everyone to refrain from wine, and the program began.... The second leader was not on the stage.

With his customary, not inelegant gesture he put out a cigarette and in the voice of a drunken person shouted into the microphone: "At our discotheque people do not drink or smoke! Let us begin to dance!" From that minute until the end of the evening, one could hear corks popping and flying out of bottles....

We had lost. It was necessary to stop and think.

One must learn in childhood or adolescence how to spend free time and holidays cheerfully and in an interesting and valuable way. To this end we have created a youth studio club. It was established by the Terpsichore Association, the Komsomol Rayon Committee of Savetskiy Rayon, and the Akademiya House of Culture. The club's subsequent work became possible because of assistance from the Commission for Communist Education of the Savetskiy CPSU Raykom, the Permanent Commission for Communist Education of Children, Adolescents and Youth, and the Presidium and local Committee of the Trade Union of the Siberian Branch of the USSR Academy of Sciences.

There were 130 senior classmen from 14 schools in the rayon who expressed a desire to work in the club. At the second meeting of the club the schoolchildren expressed their idea of musical evenings in the cafe and holidays. For the majority, the model of such an evening included smoking and the consumption of alcoholic beverages. This was also reflected in practice.

At the musical evenings in the cafe alcohol appeared on the tables in bottles labeled as nonalcoholic beverages, and they drank in the lavatories and before coming into the cafe. The consumption of alcohol was condemned by the adult organizers of the evenings, patrol members confiscated supplies of alcoholic beverages, but the drunken boys and girls felt comfortable among their contemporaries in the hall and were even proud of their drunkenness.

A situation arose in which the adults prohibited alcohol and confiscated supplies of it, but the young people contrived more and more clever methods of avoiding the prohibition and the supervision. Workers of the cafe "helped" the senior classmen, trying to supply them with alcohol. The adult organizers clearly lost and the prohibitive measures lagged behind the more clever devices for getting alcohol into the hall. Then the basic anti-alcohol was concentrated on members of the club and organizers of the evening. We thought that developing sober attitudes in them would exert an influence on the broad audience of visitors: young workers, PTU students, other students and senior classmen.

We turned out to be right. By the end of the first year of operation, 87 percent of the members of the club had assumed a negative attitude toward the consumption of alcohol during the evenings and took independent measures to put a stop to all forms of drinking. Because of this the drunk boys and girls no longer felt like heroes, the consumption of alcohol during the evenings lost its aura of prestige, and the drunken people felt uncomfortable. The consumption of alcohol during the evenings decreased sharply, and subsequently it ceased altogether.

By the 10th year of its operation the youth club/studio had prepared a large anti-alcohol program called Koltso. It develops throughout the course of the entire youth dancing evening. It is a theatrical presentation, with the active participation of the visitors in it. The program shows how alcoholic beverages at holiday celebrations and in daily life lead to many unpleasant circumstances and tragedies, and how alcoholic traditions have contributed to the dissolution of popular customs, and now impede the formation of modern customs. It shows how at a young age, when life seems endless, alcohol easily makes a person happy and his future unsure. A young person and his bride choose a life without alcohol and through their example they publicize a sober way of life.

Today the majority of youth are in favor of nonalcoholic holidays and evenings. According to data of an investigation conducted in 1985 in conjunction with K. V. Danilenko, M. Karachurin, D. A. Kinsht, N. V. Lavrova and G. A. Lavrov, which included 1,500 people, it became clear that 89 percent of the senior classmen, 80 percent of the students in tekhnikums and 70 percent of the students in PTU's were against alcohol at evening parties. The rest of those who were investigated were in favor of the consumption of alcohol. Among those investigated who had asocial behavior, 72 percent were proponents of drinking, 20 percent were opponents and 8 percent did not have any particular opinion.

What especially attracts youth in the organized forms of holiday and Sunday recreation evenings? According to data of the 1985 investigation they are: the opportunity to dance; the hear music; to meet with friends; to make new acquaintances; and to spend time in an elevated holiday situation (given in the order of preference).

Which variants of youth evenings of entertaining are most attractive? At the present time, only two forms have become widespread: evenings with music

groups and discotheques. It is easy to define the music groups; this is a fairly specific form. Here is what has turned out:

When an evening with dancing does not have a musical group, this is a discotheque, and there is no third form. Discotheques are both a form of leisure spent by youth, and the premises where such an evening is held, and the group of people who organize this type of evening.

Discotheques have been popular in our country for more than 10 years now. Thus in 1985 from 70 to 80 percent of the senior classmen, students in SPTU's, other students and young workers preferred the discotheques to all other forms of holiday parties. Then, in order of popularity, came parties at home, in cafes and in restaurants, and parties in dance halls with groups. The younger the age of those investigated, the more popular the discotheques were.

The more than a decade of the existence of discotheques in our country makes it possible today to formulate a definition on the existing practice. A discotheque is one of the forms (mainly dancing) with which the population spends leisure time, based on an interest in performing and other forms of musical art organized by leaders (disk jockeys) with the help of a controlled artificial light environment. The possibilities of discotheques and the degree of their influence are fairly limited, and we must remember this. Music groups and discotheques in and of themselves cannot fight against elements of the anticuture: drunkenness, aggressive behavior and the cult of things. They themselves require constant assistance and supervision.

The evenings of the Novosibirsk Terpsichore Association described above and the youth club-studio do not come under the definition of discotheques. They can be defined as one of the forms of leisure that are based on interest in culture and art, including performance music and dances, that are organized by the collective of the club with the active participation of visitors and with the help of controlled artistic sound and light environment and theater presentation. We have called this form theaterized dancing leisure of youth (TeTaDo). From our standpoint this is the most promising variant (we are not including sports) of the organization of holiday and Sunday (mainly evening) leisure. In essence this form, as distinct from the others, can exist only with the active participation of the visitors themselves. It includes the fight against manifestations of the anticuture.

Today many are convinced that the organization of the free time of youth, especially on Sundays and holiday evenings, is a most important aspect of the struggle for a healthful, sober way of life. This also includes observance of the principle advanced by one of the activists of the sobriety movement, S. N. Sheverdin, concerning continuous propaganda in anti-alcohol work [Footnote 7] and the possibility of effectively influencing large groups and collectives of youth. Thus, according to foreign experience, of the 25 various plans for prevention of drunkenness and alcoholism suggested by the "National Institute for the Study of Drunkenness and Alcoholism" in the United States, three were selected and realized: "The model of prevention for youth unions," "the model for prevention for schools and collectives," and the "model for education in an aspect of health protection." All plans are oriented toward the sociocultural model of prevention [Footnote 8]. It would seem that the local

youth organizations of the all-union voluntary society for fighting against sobriety would do well to engage in the organization of free time (nightlife) of broad segments of youth. When the local organizations as clubs have their own names and logos, and their members not only refrain from alcohol themselves, but also engage in concrete work and the youth leaders become popular, then one can expect rapid progress in the struggle for Souther youth.

Today it is important to improve the training of specialists engaged in the eradication of drunkenness and alcoholism, above all physicians [Footnote] and to develop more rapidly the training of instructors, legal experts and workers in the sphere of free time. In particular, this will make it possible to account correctly for mistakes of the present day and not to repeat them in the future.

The suggestion of the EKO editorial staff to convene an all-union conference for developing strictly scientific approaches to the implementation of the decree of the CPSU Central Committee, "On Measures for Eradicating Drunkenness and Alcoholism" [Footnote 10] is timely and necessary. During the course of preparations for such a conference it is important for specialists in various areas of knowledge to publish articles presenting the results of their research in a simple language that is at free of it can be of specialized term. It is necessary to have a profound knowledge of the real situation and those tendencies that are forming in front of our eyes.

Today--sober youth, tomorrow--a sober society.

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## WORKER NEGLIGENCE, IRRESPONSIBILITY SATIRIZED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 187-190

[Article by Galina Vrublevskaya: "Peaceful Work, a Quite Serious Story"]

[Text] It is nighttime. The shop is asleep. One can hear the regular breathing of the ventilators. Something has started to squeak down below. The robot has collected its regular portion of charges in order to stoke the furnace. The furnace cracked its lips greedily. It started to hum in gratitude.

I was sitting up above, in the gallery. Here stands a computer that commands the robot. Our trio, the furnace, the robot and the computer, a trio with the flashy title GAP, has made noise throughout the entire plant. The management proudly brings important guests to our shop and they are inevitably enraptured by our new line.

But today everything is calm. We are not expecting anybody. I am sitting and knitting a copy. I am not doing anything else. My work is such that there is nothing to do. All I have to do is check to make sure the computer is putting out its printouts, establishing the control figures of the process.

From time to time, having laid down my knitting, I go up to the teletype and, more out of habit than of necessity, my eyes run over the lines of print. Everything is in order. Yes, the computer is stronger than a human--it does not get tired or diverted.

"Tatyana, are you sleeping?" Kiril, the shift engineer, asks

I do not see him, he is sitting at the instrument panel and soldering something.

I can clearly envision Kiril's round face with his eternal joyous smile. The engineer and I while away the time together at night: We are not supposed to have more than one person at a machine.

"I am not sleeping," I answered, suddenly remembering something.

I tried on the hat. The green crown stood out against my reddish hair. It turned out well! I also have a dark green dress. I am really looking pretty good.

But Kiril does not appreciate my hair. And his smile now is not directed at me. His thoughts are directed toward another, and not just his thoughts.

"Tanechka, will you take over for a couple of hours, I have to run to see a friend."

"Go ahead," I say. We know what kinds of friends one visits at 12 o'clock at night. I take over the control. There is nothing to do here at night either.

He has left.

The silence is even denser. Only the furnace hums down below, like any electric wire in a winter forest.

I go and take a look at how my computer is doing. The printout has already slithered onto the floor. Thus the parameters are within the norm.

And here is the timer's autograph: it has marked 12/30.

It is time to rest a while. Here is my bed: three chairs and a piece of porolon, I guess. I lie down, but I will not sleep. Anyway, I am alone today.

So I cover myself up with my coat....

Uh-oh, I almost fell off the chairs. Three o'clock in the morning?

I jump. Again, it turns out, I have fallen asleep. I will just lie down and...like in a shoe.

The quiet is somehow strange. And the computer has grown still. Even the teletype is not chattering. It is even suspicious.

I felt it in my heart! An emergency situation--AVOST.

This is the first time for such an unpleasant thing. Did the breakdown happen a long time ago? Did the furnace become cold all of a sudden?

But where are the instructions? Here they are. So: "Changing to Manual Operation.... Temperature. Pressure...."

I quickly introduced the parameters into the computer. Let us go, robot, wind up and give out heat. It would seem that it has worked. The crystals in the furnace have not hardened you.

But what about their properties? Is this really defective? Well, they will not notice right away. And during assembly they will not be able to figure out on whose shift the crystals were baked.

And the control printout? From it I see immediately that the AVOST took place and how much time the furnace stood there without control.

Where are the scissors? Here, we sill cut off this little piece, and then glue it back together. Nothing will be noticed. They will think that the perforated part of the paper tore. This happens sometimes....

Kiril returned, satisfied.

"Tatyana, take off, I will take over."

Should I tell him or not?

I will tell him. After all, he will be responsible if anything happened.

"Kiril," I said, "I slept through an AVOST."

"What do you mean?" He even swallowed his smile. "And the furnace got cold?"

"No, it did not get cold," I answered. I managed to turn it over to manual control."

Kiril ran up to the teletype. He gazed at the control printout.

"And where is the notification of the AVOST?" he asked.

"It did not note anything!"

I even smiled.

"No, then nothing happened!"

"Why did you cut off this piece?" he guessed.

"Didn't I glue it back together fairly well?" I praised myself.

Kiril nervously paced around the computer. My keen ear followed his steps. The engineer's round face became rectangular from tension.

"But the crystals have been spoiled, how is it you do not understand this!" he became irritated. "The technology has been violated and the properties will be different."

"Who will find out about it? Just say the furnace never cooled off...."

"But we know. And why did you tell me? It would have been better to keep your mouth shut!"

"Now we can keep our mouths shut together!" I laughed.

"I trusted you," the engineer was disturbed. "You should have at least a little bit of responsibility."

And he started to talk about responsibility again. Rather than running off to see Lyalka, he should have put the processor on the reserve computer. There, the payments are tossed up on the assembly table however they fall.

I remained silent.

"In the morning we will have to report this to the chief of the GAP," he said gloomily. "This batch of crystals should be rejected."

"If you don't mind losing your quarterly bonus, think about your reputation an engineer," I said sarcastically. "Incidentally, I think not only the bosses but also your wife will be interested to find out where you go at night when you leave your workplace."

Kiril went up to the computer, switched it over to manual operation and began to check the properties of the crystal. The necessary figures lit upon the screen in sequence.

"Well, how is it?" I was interested.

"All parameters except for one are within allowable limits," answered Kiril thoughtfull. "The longitudinal resilience is lower than the norm."

"Well, that's nothing," I lightly waved my hand.

"So these crystals will simply 'take off' twice as fast."

"Just think, somebody's television set will break down a year ahead of time. There are not enough of them and they break down even without our intervention..."

"You have convinced me," Kiril sighed. "We shall keep quiet."

He carelessly went to the assembly table over which hung a poster: "Production Without Humans--The Progress of Our Technology."

I lay down on the chairs again and closed my eyes.

"I have a good, peaceful job," I thought, already falling asleep.

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## PROVERBS DESCRIBE POOR WORK ATTITUDES

Novosibirsk EKONOMIKA I ORGANIZATSIIA PROMYSHLENNOCO PROIZVODSTVA (EKO) in Russian No 1, Jan 87 pp 190

[Article by K. Valeri: "Thoughts About Loafers and Bureaucrats"]

[Text] If one civilization began with the Stone Age, can another begin with the age of unnecessary papers?....

Jacques Barzun, French writer

Disorder is the greater the more it is organized!

A. Saure, French humorist

A bureaucrat is a person who tells you the final "maybe."

Sam Goldwyn, American humorist

Bureaucracy is something like fishing where there are no fish.

N. Parkinson, English writer.

A work commission is a group of people, each of whom personally can resolve nothing but who together assert that the problem has not been prepared....

A. Smith, English publicist

If you hire people whose business qualities are not as good as yours, in so doing you are proving that you are beneath them.

R. G. Grant

If you want to do something well, select a busy person for it, for another person will not have enough time.

E. Hubbard

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**END OF**

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